

This is a scanned version of the text of the original Soil Survey report of Madison County Area, Idaho issued January 1981. Original tables and maps were deleted. There may be references in the text that refer to a table that is not in this document.

Updated tables were generated from the NRCS National Soil Information System (NASIS). The soil map data has been digitized and may include some updated information. These are available from <http://soildatamart.nrcs.usda.gov>.

Please contact the State Soil Scientist, Natural Resources Conservation Service (formerly Soil Conservation Service) for additional information.

Foreword

This soil survey contains information that can be used in land-planning programs in Madison County Area, Idaho. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

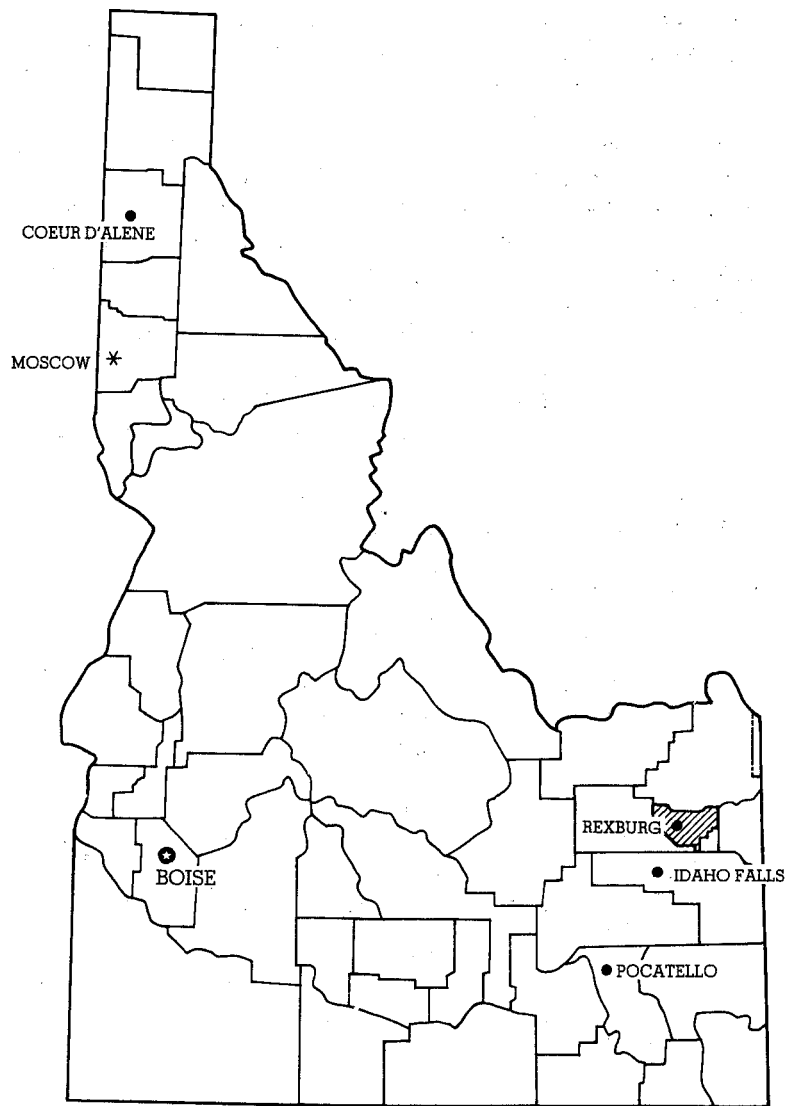
This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

A handwritten signature in black ink, reading "Amos I. Garrison, Jr." with a stylized flourish at the end.

Amos I. Garrison, Jr.
State Conservationist
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Location of Madison County Area in Idaho.

Soil Survey of Madison County Area Idaho

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Conservation Commission

United States Department of Agriculture, Soil Conservation Service
in cooperation with University of Idaho, College of Agriculture, and
Idaho Soil Conservation Commission

MADISON COUNTY AREA is in southeastern Idaho. The county has a total area of about 473 square miles or 302,720 acres. The survey area encompasses 405 square miles or 259,200 acres. The remaining 43,520 acres is in the Targhee National Forest and is not included in this survey. In 1967 about 86,000 acres was used

for irrigated cropland, and the rest of the area was mainly used for nonirrigated cropland and rangeland. Rexburg, the county seat, has a population of 13,452.

Elevation of most of the area ranges between 4,800 feet in the river valley to about 7,000 feet along the boundary of the National Forest.



Figure 1.-Northeastern view of Rexburg Valley from atop South Menan Butte. Bondbranch soils are in the foreground. In the center is Henrys Fork of the Snake River. Labenzo and Blackfoot soils are in the background.

The valley around Rexburg is mostly water deposited material (fig. 1). The relatively small area on the extreme west side of the county area is wind worked sandy material over a basalt flow. A major part of the county area is deep loess over rhyolite or basalt.

General nature of the survey area

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Sugar City, Idaho in the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 21 degrees F, and the average daily minimum temperature is 11 degrees. The lowest temperature on record, which occurred at Sugar City on December 5, 1972, is -39 degrees. In summer the average temperature is 63 degrees, and the average daily maximum temperature is 81 degrees. The highest recorded temperature, which occurred on July 14, 1974, is 97 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 13 inches. Of this, 7 inches, or 55 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 5 inches. The heaviest 1-day rainfall during the period of record was 2.20 inches at Sugar City on November 1, 1956. Thunderstorms number about 24 each year, 16 of which occur in summer.

Average seasonal snowfall is 49 inches. The greatest snow depth at any one time during the period of record was 27 inches. On the average, 30 days have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 45 percent. Humidity is higher at night, and the average at dawn is about 65 percent. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in April.

History and development

The first men reported to have settled in Madison County Area were Andrew Henry and his group of trappers, who were chased out of Montana by the Blackfoot Indians. The winter of 1810 was upon them, so a make

shift fort and shelter were built just downstream from St. Anthony.

Wilson Price Hunt wanted to establish a trading post at the mouth of the Columbia River. After reaching the Pacific, his combined land and water expedition suffered a disaster when the boat, which had gone around South America, was sunk in an Indian raid. To get the news back to his company, a group of seven men were chosen to go overland to St. Louis. They were led by Robert Stuart. Indians raided them near the present head of Palisades Reservoir and stole their horses, so they built a raft and floated down the Snake River to the Ririe area. On September 29, 1812, they crossed the Rexburg bench and made their evening camp at the forks of Moody Creek. Their next camp was at the hot springs on Canyon Creek.

Large fur companies sent trappers into the area between 1822 and 1834, but problems with the Indians restricted most of their efforts to the Yellowstone area and the Rockies. After the fur trade began to decline in the early 1830's, the large fur companies withdrew, and only a few trappers remained in the area.

John R. Poole worked for the Utah Northern Railroad as it was being constructed northward from Idaho Falls, then known as Eagle Rock, to the Montana border. During his spare time he explored the Menan area and was convinced that the area could support a community. Poole traveled to Ogden, Utah to report his findings to the Mormon Church. The church had planned to send people into the area. This effort brought several families into Madison County Area.

In October, 1822, William B. Preston was assigned by church leaders to travel to the new area. He returned to Utah with a favorable report. Around 1883, Thomas E. Ricks, a bishop of the Mormon Church, selected a town site for Ricksburg. The name was later changed to Rexburg before it was registered at Blackfoot with the U.S. Territorial Land Office.

The area grew rapidly until Idaho became a state in 1890. Ricks College at Rexburg was established on November 12, 1888, making it the oldest center of higher education in Idaho.

When Rexburg became a community, the area was part of Oneida County, which was organized January 22, 1864. The county seat was originally Soda Springs, but it was later moved to Malad City. On January 13, 1885, the area was included in Bingham County with Blackfoot as the county seat. On March 4, 1893, Fremont County was created with St. Anthony chosen as the county seat. Fremont County was later divided into Clark, Jefferson, Madison, and Teton Counties. Madison County was formed on November 7, 1913.

The following communities border Rexburg about five miles in each direction: Salem, directly north; Plano and Hibbard, to the northwest; and Sugar City, Moody, Teton, and Newdale to the northeast (3).

Natural resources

Soil and water are probably the most important natural resources in the area. Crops produced on farms and livestock are marketable products derived from soil and water.

The Snake and Teton Rivers provide water for most of the canal systems in the valley. In most of the area, water is adequate for farm use. The Rexburg bench, which is above the canal systems, is sprinkler irrigated by underground water.

The limited amount of industry in the county is all connected with agriculture.

Farming

After the fur industry declined in 1830, some trappers turned to ranching and farming in the area. The first livestock production was in the Moody area. The expansion northward from Utah and the cheap land available under the Homestead Act brought an influx of farmers and ranchers into the area. Because of the dry climate and abundant stream and river flows, numerous irrigation ditches were built. The earliest water right was issued June 10, 1883 from the South Fork of the Teton River. The dry winter of 1933-34 prompted farmers to organize the Fremont-Madison Irrigation District. Through this organized effort, the Island Park and Grassy Lake reservoirs were built during 1938-39.

Grain and hay were the principal crops until the completion of the railroad branch line from Idaho Falls to Rexburg on November 22, 1889. From then on perishable potatoes could be grown and shipped without spoiling. To cope with restricted acreages and cost increases, farmers converted to sprinkler irrigation. This turned Madison County into a major potato producing area.

The first great boom of wealth for the area was the sugar beet industry. Labor problems, plant disease, and poor yields, however, caused sugar beets to become a minor crop. The largest sugar beet factory of the time was built at Sugar City in 1904.

The large Rexburg bench had only been used for cattle and sheep grazing until Albert Luthy showed that nonirrigated wheat could be grown on the bench. The greater demand for farm products and the use of large farm machinery during the period immediately before and after World War II resulted in the development of prosperous nonirrigated farms on the bench.

In 1967 there was about 172,000 acres of cropland in the area. Of this, about 86,000 acres was irrigated, and the other half was nonirrigated. The rest of the area was mainly used for pasture or rangeland (6).

Dairy cattle have always been important to the area. Prior to 1940 there were a few milk cows on each farm. Today the dairy industry is located on a few farms averaging 60 to 100 cows per herd.

Beef cattle are important in Madison County. There are cow-calf operators, small feedlot operators, and

small purebred breeding operations. The area has always been self-sustaining in forage productions for this industry.

Range sheep industry used to be important, but it is no longer economically important. At one time Madison County was a large swine producing area, but this is now a minor industry.

The enactment of the Soil Conservation District legislation in 1937 stirred the interest of many landowners by providing them with the opportunity to form organizations to solve their mutual problems. The Madison Soil and Water Conservation District was organized in 1948 to aid the farmers in making more efficient use of irrigation water, to control the soil blowing on sandy soils, and to control water erosion on the silty soils of the Rexburg bench.

The failure of the Teton Dam on June 5, 1976 released some 250,000 acre-feet of water over approximately 35,000 acres of Madison County (fig. 2). Most of

the area covered by the floodwater was cropland or pasture. Some areas suffered extensive scouring while other areas had deposits as much as 4 feet deep (fig. 3).

The greatest percentage of the area, however, suffered only minor damage to cropland. Many ditches and roadways were heavily damaged, and debris was scattered over the entire flood area.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures (4). They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine



Figure 2.-An area of Haplaquolls damaged by the flood caused by the collapse of the Teton Dam.

their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication

shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soils on high dissected plateaus

These moderately deep and deep, well drained soils



Figure 3.-Silt deposition on Mathon sandy loam, 0 to 6 percent slopes, following the flood caused by the collapse of the Teton Dam.

are on high dissected plateaus. They formed in silty windlaid material. They are in the eastern part of the survey area.

Elevation ranges from 5,700 to 7,000 feet, and mean annual precipitation ranges from 14 to 20 inches. The mean annual air temperature is about 39 degrees F., and the frost-free season is 60 to 85 days. The soils are mainly used for nonirrigated crops.

Three general soil map units in the survey area are in this group. They make up 30 percent of the survey area.

1. Karlan-Ard

Gently sloping to moderately sloping, moderately deep, well drained soils

This map unit consists of soils that formed in silty windlaid material over residuum from rhyolite on dissected plateaus. Slopes are 4 to 12 percent.

This map unit makes up about 2 percent of the survey area. It is about 25 percent Karlan soils and 25 percent Ard soils. The rest is soils of minor extent.

Karlan soils are generally on dissected plateaus. Typically, the surface layer is dark grayish brown silt loam about 17 inches thick. The subsoil is dark brown and brown silt loam about 11 inches thick. The substratum is white, violently effervescent gravelly loam about 3 inches thick over fractured rhyolitic tuff.

Ard soils are generally on eroded south- and east-facing exposures on the plateaus (fig. 4). Typically, the surface layer is dark grayish brown and grayish brown silt loam about 12 inches thick. The underlying material is white, violently effervescent flaggy silt loam and grayish brown flaggy loam about 13 inches thick over fractured rhyolitic tuff.

The soils of minor extent are Swanner and Rammel soils on stony canyon sides; Judkins soils on steep, stony north-facing exposures under forest vegetation; deep Tetonia soils on north-facing exposures; Ririe soils on south-facing exposures; Lantonia soils along drainageways; and deep Greys and Turnerville soils under forest vegetation.

Most of the soils in this unit are used for nonirrigated production of small grain. Some areas are used for range and wildlife habitat. The potential native vegetation consists mainly of sagebrush, bluebunch wheatgrass, Nevada bluegrass, and Idaho fescue. These soils provide openland and rangeland habitat for wildlife, such as small mammals, birds, and mule deer.

These soils have a limitation for urbanization mainly because of the depth to bedrock. Slope is the main limitation for recreational facilities.

2. Tetonia-Ririe

Nearly level to strongly rolling, deep, well drained soils



Figure 4.-Area of Ard silt loam, 4 to 12 percent slopes, under sagebrush and grass vegetation. In the background are Greys soils under quaking aspen, Judkins soils under evergreen trees, and Swanner soils on steep exposed slopes.

This map unit consists of soils that formed in silty, windlaid material on dissected plateaus. Slopes are 0 to 20 percent.

This map unit makes up about 24 percent of the survey area. It is about 35 percent Tetonia soils and 25 percent Ririe soils. The rest is soils of minor extent.

Tetonia soils are generally on north- and east-facing exposures and upper parts of drainageways. Typically, the surface layer is dark grayish brown silt loam 10 inches thick. The subsoil is brown silt loam 12 inches thick. The substratum is light brownish gray, violently effervescent silt loam to a depth of more than 60 inches.

Ririe soils are generally on south- and west-facing exposures and ridges. Typically, the surface layer is grayish brown silt loam 9 inches thick. The underlying material is pale brown and light gray, violently effervescent silt loam to a depth of more than 60 inches.

The soils of minor extent are Greys soils on north- and east-facing exposures under aspen vegetation; Lantonia soils in drainageways; Ard soils on eroded south- and east-facing exposures; stony and steep Rammel soils; and Swanner soils on stony canyon sides. All of these soils are well drained.

Nearly all of the soils in this unit are used for nonirrigated wheat and barley (fig. 5). Small areas along canyon walls and on steep slopes are used for range and wildlife habitat. These soils provide rangeland and openland habitat for wildlife, such as songbirds, birds of prey, small mammals, upland game birds, and mule deer.

Many of the soils in this unit are suited to irrigated crops. Sprinkler irrigation is the most suitable method. Irrigation is not normally suited to more than 12 percent slopes.

These soils have limitations for urban development mainly because of permeability, slope, and low strength. These factors should be considered when choosing sites for structures, sanitary facilities, and local roads and streets. Slope and dustiness are the main limitations for recreational facilities.

3. Greys-Turnerville

Gently sloping to hilly, deep, well drained soils

This map unit consists of soils that formed in silty windlaid material. Slopes are 2 to 30 percent.

This map unit makes up about 4 percent of the survey area. It is about 60 percent Greys soils and about 35 percent Turnerville soils. The rest is soils of minor extent.

Greys soils are generally on south- and west-facing exposures predominantly under aspen vegetation (fig. 6). Typically, the upper part of the surface layer is dark grayish brown silt loam about 4 inches thick. The lower part is brown silt loam about 12 inches thick. The subsurface layer is pale brown silt loam about 7 inches thick. The subsoil is light yellowish brown silt loam to a depth of more than 60 inches.



Figure 5.-Tetonia-Ririe silt loams, 4 to 12 percent slopes, used for dryland grain and inclusions of Greys silt loam under quaking aspen vegetation.



Figure 6.-Aspen Grazeable Woodland range site under quaking aspen on Greys silt loam. Understory vegetation includes pine reedgrass, mountain brome, serviceberry, and chokecherry.

Turnerville soils are generally on less steep north- and east-facing exposures, predominantly under lodgepole pine vegetation. Typically, the surface layer is light brownish gray and light gray silt loam about 6 inches thick overlain by a 1- to 3-inch mat of decomposed or partially decomposed leaves and twigs. The subsurface layer is light gray silt loam about 10 inches thick. The upper part of the subsoil is light gray and pinkish gray silty clay loam about 41 inches thick. The lower part of the subsoil is light brownish gray silt loam to a depth of more than 60 inches.

The soils of minor extent are Lantonia soils in drainageways; Tetonia and Ririe soils on south- and west-facing exposures and along ridges; and steep and stony Rammel soils. These soils are all well drained and are generally used for grassland or nonirrigated cropland.

The soils in this unit are mostly used for recreation, range, and wildlife habitat. These soils provide woodland habitat for such wildlife as songbirds, birds of prey, small mammals, game birds, and big game. There is some harvesting of lodgepole pine for the production of posts and poles.

The soils in this unit have limitations for urban development mainly because of low strength, slope, potential frost action, and permeability. These factors should be considered when choosing sites for structures, sanitary facilities, and local roads and streets. Slope and dustiness are the main limitations for recreational facilities.

Soils on low dissected plateaus

These moderately deep over hardpan and deep soils are on low dissected plateaus. They formed in silty windlaid material. They are in the central part of the survey area.

Elevation ranges from 4,800 to 5,700 feet, and mean annual precipitation ranges from 12 to 15 inches. The mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days. The soils are used for both irrigated and nonirrigated crops.

Two general soil map units in the survey area are in this group. They make up 34 percent of the survey area.

4. Rexburg-Ririe

Nearly level to hilly, deep, well drained soils

This map unit consists of soils that formed in silty windlaid material on dissected plateaus. Slopes are 0 to 30 percent.

This unit makes up about 29 percent of the survey area. It is about 45 percent Rexburg soils and 40 percent Ririe soils. The rest is soils of minor extent.

Rexburg soils are generally on north- and east-facing exposures and in concave areas. Typically, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is brown and light brownish gray silt loam about 9 inches thick. The substratum is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Ririe soils are generally on south- and west-facing exposures and along ridges. Typically, the surface layer is grayish brown silt loam about 9 inches thick. The underlying material is pale brown and light gray, violently effervescent silt loam to a depth of more than 60 inches.

The soils of minor extent are Pocatello variant soils on the steeper parts of the south-facing exposures; Panmod soils on ridgetops and upper parts of the south-facing exposures with a cemented hardpan between a depth of 20 and 40 inches; stony Swanner and Rammel soils along canyon walls; and poorly drained Haplaquolls along drainageways.

The soils in this unit are mainly used for nonirrigated wheat and barley. Extensive areas are also used for irrigated wheat, barley, potatoes, and alfalfa hay (fig. 7). These soils provide openland and rangeland habitat for wildlife, such as small mammals, birds, and mule deer.

The soils in this unit have limitations for urban development mainly because of permeability, low strength, slope, and potential frost action. These factors should be considered when choosing sites for structures, sanitary facilities, and local roads and streets. Slope and dustiness are the limitations for recreational facilities.

5. Panmod-Rexburg-Ririe

Very gently sloping to moderately sloping, moderately deep and deep to hardpan, well drained soils

This map unit consists of soils that formed in calcareous, silty windlaid material on dissected plateaus. Slopes are 0 to 30 percent.

This unit makes up about 5 percent of the survey area. It is about 55 percent Panmod soils, 30 percent Rexburg soils, and 15 percent Ririe soils.



Figure 7.-Sprinkler irrigation on Rexburg and Ririe soils southeast of Rexburg. These soils are used for irrigated wheat, barley, and potatoes.

Panmod soils are generally on ridgetops and the more gentle south-facing exposures. They are moderately deep to hardpan. Typically, they have a surface layer of brown, slightly effervescent silt loam about 11 inches thick. The subsoil is light brownish gray, violently effervescent silt loam about 14 inches thick over the 11-inch thick hardpan. Below a depth of 36 inches is pinkish white silt loam extending to a depth of 50 inches over a second hardpan layer. The second hardpan layer commonly overlies basalt.

Rexburg soils are generally on north- and east-facing exposures and in concave areas. They are deep to hardpan. Typically, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is brown and light brownish gray silt loam about 9 inches thick. The substratum is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Ririe soils are generally on south- and west-facing exposures and along ridgetops. They are deep to hardpan. Typically, the surface layer is grayish brown silt loam about 9 inches thick. The underlying material is pale brown and light gray, violently effervescent silt loam to a depth of more than 60 inches.

The soils in this unit are mainly used for nonirrigated wheat and barley. Extensive areas are also used for irrigated wheat, barley, potatoes, and alfalfa hay. These soils provide openland and rangeland habitat for wildlife, such as small mammals, birds, and mule deer.

The soils in this unit have limitations for urban development because of permeability, low strength, slope, and potential frost action. These factors should be considered when choosing sites for structures, sanitary facilities, and local roads and streets. Slope and dustiness are the main limitations for recreational development.

Soils on river terraces and flood plains

These deep, very poorly drained to well drained soils are on river terraces and flood plains. They formed in mixed alluvium or sandy alluvium. They are in the west-central, south-central, and northwestern part of the survey area.

Elevation is about 4,800 feet, and mean annual precipitation is about 12 inches. The mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days. These soils are mainly used for irrigated crops and pasture.

Six general soil map units in the survey area are in this group. They make up 28 percent of the survey area.

6. Haplaquolls

Nearly level, deep, very poorly drained or poorly drained soils on flood plains

This map unit consists of soils that formed in mixed alluvium on flood plains. Slopes are 0 to 1 percent.

This unit makes up about 4 percent of the survey area. It is about 80 percent Haplaquolls and 20 percent soils of minor extent.

Haplaquolls are in channeled flood plains along streams and have variations in texture and color. These soils generally are silt loam to clay and 20 to 40 inches deep over sand or sand and gravel. Some areas of these soils are deep to sand and gravel.

The soils of minor extent are the deep, very poorly drained, sandy, Typic Psammaquents; deep, somewhat poorly drained, medium textured Blackfoot soils; deep, moderately well drained, moderately fine textured Annis soils; moderately deep to sand and gravel, moderately well drained, medium textured Labenzo soils; and shallow to sand and gravel, somewhat excessively drained Wardboro soils and water areas.

The soils in this unit are mostly used for native grazing land and wildlife habitat. They provide openland and wetland habitat for wildlife, such as small mammals, waterfowl, songbirds, and mule deer. A few areas that have better drainage are cultivated and used for small grain and seeded pasture.

The soils in this unit have limitations for urban development mainly because of wetness, the variation in texture, and depth to sand and gravel. These factors should be considered when choosing sites for buildings, local roads and streets, and sanitary facilities.

These soils have potential for recreational facilities if the wetter areas are avoided. Possible facilities include campgrounds, picnic areas, paths and trails, or golf courses.

7. Withers-Annis

Nearly level, deep, somewhat poorly drained and moderately well drained, moderately fine textured soils; on river terraces and flood plains

This map unit consists of soils that formed in mixed alluvium. Slopes are 0 to 1 percent.

This unit makes up about 8 percent of the survey area. It is about 30 percent Withers soils and 25 percent Annis soils. The rest is soils of minor extent.

The Withers soils are somewhat poorly drained and are on river terraces and flood plains. Typically, the surface layer is grayish brown silty clay loam about 7 inches thick. The subsoil is grayish brown and pale brown silty clay loam about 19 inches thick. The upper part of the substratum is pale brown, very gravelly loamy sand about 10 inches thick, and the lower part is sand and gravel to a depth of more than 60 inches. Depth to sand and gravel ranges from 20 to 36 inches.

The Annis soils are moderately well drained and are on river terraces. Typically, the surface layer is grayish brown silty clay loam in the upper 7 inches and grayish brown silt loam in the lower 5 inches. The subsoil is light brownish gray silt loam about 9 inches thick. The upper part of the substratum is light brownish gray and gray, mottled silty clay loam about 17 inches thick. The lower part of the substratum is light gray, mottled silt loam to a depth of more than 60 inches.

The soils of minor extent are moderately deep to sand and gravel, medium textured Labenzo soils; deep,

medium textured Blackfoot soils; poorly drained to very poorly drained Haplaquolls; and shallow to sand and gravel, somewhat excessively drained Wardboro soils.

The soils in this unit are almost entirely used for irrigated hay, wheat, barley, pasture, and potatoes. These soils provide openland and wetland habitat for wildlife, such as small mammals, waterfowl, songbirds, and mule deer.

The soils in this unit have limitations for urban development mainly because of permeability and low strength. These factors should be considered when choosing sites for buildings, local roads and streets, and sanitary facilities.

8. Labenzo-Blackfoot

Nearly level, deep, somewhat poorly drained and moderately well drained, medium textured soils, on river terraces and flood plains

This map unit consists of soils that formed in mixed alluvium. Slopes are 0 to 1 percent.

This unit makes up about 6 percent of the survey area. It is about 40 percent Labenzo soils and 25 percent Blackfoot soils. The rest is soils of minor extent.

The Labenzo soils are moderately well drained. Typically, the surface layer is grayish brown silt loam about 13 inches thick. The underlying material is stratified pale brown, light brownish gray, and dark gray silt loam and loamy sand about 21 inches thick over sand and gravel to a depth of more than 60 inches. Mottles are common below a depth of 17 inches.

The Blackfoot soils are somewhat poorly drained. Typically, the surface layer is grayish brown silt loam about 10 inches thick. The upper part of the underlying material is light brownish gray, mottled silt loam about 25 inches thick. The lower part is stratified, mottled silt loam, silty clay loam, and sandy loam to a depth of about 60 inches.

The soils of minor extent are deep, moderately well drained, medium textured Annis and Heiseton soils; moderately deep over sand and gravel, somewhat poorly drained Withers soils; and poorly drained and very poorly drained Haplaquolls.

The soils in this unit are almost entirely used for irrigated hay, wheat, barley, pasture, and potatoes. These soils provide openland and wetland habitat for wildlife, such as small mammals, waterfowl, songbirds, and mule deer.

The soils in this unit have limitations for urban development mainly because of permeability and low strength. These factors should be considered when choosing sites for structures, local roads and streets, and sanitary facilities.

9. Bannock-Bockston-Wardboro

Nearly level, deep, well drained and somewhat excessively drained, medium textured and moderately coarse textured soils, on river terraces

This map unit consists of soils that formed in mixed alluvium on river terraces. Slopes are 0 to 1 percent.

This unit makes up about 4 percent of the survey area. It is about 40 percent Bannock soils, 15 percent Bockston soils, and 15 percent Wardboro soils. The rest is soils of minor extent.

Bannock soils are well drained. They are moderately deep to sand and gravel. Typically, the surface layer is grayish brown loam about 7 inches thick. The subsoil is grayish brown and light brownish gray loam about 8 inches thick. The upper part of the substratum is white silt loam and light brownish gray gravelly loam 10 inches thick; the lower part is loose sand and gravel to a depth of more than 60 inches. Depth to sand and gravel ranges from 20 to 40 inches.

Bockston soils are well drained. They are deep to sand and gravel. Typically, the surface layer is grayish brown loam about 10 inches thick. The subsoil is pale brown loam about 11 inches thick. The upper part of the substratum is pale brown, strongly effervescent loam about 8 inches thick. The lower part of the substratum is white, violently effervescent silt loam and fine sandy loam about 21 inches thick. It is underlain by loose sand, gravel, and cobbles to a depth of more than 60 inches. Depth to sand and gravel ranges from 44 to 50 inches or more.

Wardboro soils are somewhat excessively drained. They are shallow to sand and gravel. Typically, the surface layer is light brownish gray gravelly loam about 2 inches thick. The upper part of the underlying material is light brownish gray gravelly sandy loam about 10 inches thick, and the lower part is loose sand and gravel to a depth of more than 60 inches. Depth to sand and gravel ranges from 10 to 20 inches.

Of minor extent are Xerofluvents along the Snake River, which are predominantly under cottonwood and willow vegetation; Riverwash, which consists mainly of frequently flooded sand and gravel bars along the Snake River; moderately well drained Blackfoot soils; light colored Harston soils; moderately well drained Heiseton soils; and moderately well drained Labenzo soils. Blackfoot, Harston, Heiseton, and Labenzo soils are throughout the landscape.

Nearly all of the soils in this unit are used for irrigated hay, wheat, barley, potatoes, and pastures. These soils provide openland habitat for wildlife, such as small mammals and songbirds.

The soils in this unit have a limitation for urban development mainly because of the rapid permeability of the underlying sand and gravel. This factor should be considered when choosing sites for sewage lagoons and sanitary landfills. Local roads and streets need to be designed to avoid damage by frost action.

10. Heiseton-Harston

Nearly level, deep, moderately well drained and well drained, medium textured and moderately coarse textured soils; on river terraces and flood plains

This map unit consists of nearly level soils that formed in mixed alluvium on flood plains and river terraces. Slopes are 0 to 1 percent.

This unit makes up about 3 percent of the survey area. It is about 40 percent Heiseton soils and 40 percent Harston soils. The rest is soils of minor extent.

Typically, Heiseton soils have a surface layer of light brownish gray loam about 6 inches thick. The underlying material to a depth of 60 inches is pale brown and light brownish gray, stratified loamy sand, loam, sandy clay loam, and coarse sand. Mottles are common below a depth of 20 inches. A water table fluctuates between depths of 4 to 6 feet late in spring and summer. Some areas of these soils are underlain by sand and gravel between depths of 40 to 50 inches.

Typically, Harston soils have a surface layer of light brownish gray sandy loam about 8 inches thick. The upper part of the underlying material is light brownish gray sandy loam about 16 inches thick. The lower part of the underlying material is light gray loamy sand about 4 inches thick over loose sand and gravel to a depth of more than 60 inches. Depth to sand and gravel ranges from 25 to 40 inches. In some profiles the lower part of the underlying material is sandy loam or gravelly sandy loam.

The soils of minor extent are Xerofluvents along the Snake River, predominantly under cottonwood and willow vegetation; Riverwash, along the Snake River; dark colored Bannock, Bockston, and Blackfoot soils; poorly drained Haplaquolls; and shallow to sand and gravel, somewhat excessively drained Wardboro soils. Bannock, Bockston, Blackfoot, and Wardboro soils and Haplaquolls are throughout the landscape.

The soils in this unit are almost entirely used for irrigated hay, wheat, barley, pasture, and potatoes. Small areas of these soils are along the Snake River and provide openland habitat for wildlife, such as small mammals, songbirds, birds of prey, and upland game birds.

The soils in this map unit have a limitation for urban development mainly because of the rapid permeability of the underlying sand and gravel. Care should be taken when constructing sanitary facilities to prevent seepage and pollution of ground water.

11. Eginbench

Nearly level, deep, somewhat poorly drained, coarse textured soils; on river terraces

This map unit consists of somewhat poorly drained soils that formed in sandy, mixed alluvium on river terraces. Slopes are 0 to 1 percent.

This unit makes up about 3 percent of the survey area. It is about 80 percent Eginbench soils, and the rest is soils of minor extent.

Typically, Eginbench soils have a surface layer of brown loamy coarse sand about 8 inches thick. The upper part of the underlying material is brown and light brownish gray loamy coarse sand about 31 inches thick

with faint dark brown mottles. The lower part of the underlying material is pale brown coarse sand to a depth of more than 60 inches. An induced water table caused by subirrigation is between depths of 14 to 36 inches.

The soils of minor extent are somewhat excessively drained Grassy Butte soils, well drained Mathon and Modkin soils, and poorly drained Haplaquolls. There are also small areas of rock outcrop. These soils are mostly along the fringes of this map unit.

The soils in this map unit are mostly used for irrigated hay, potatoes, sugar beets, wheat, barley, and pasture. These soils provide openland and wetland habitat for wildlife, such as small mammals, waterfowl, songbirds, and mule deer.

The soils in this unit have a limitation for urban development mainly because of the high water table. This factor should be considered when choosing sites for structures and sanitary facilities.

Soils and rock outcrop on basalt plains

These moderately deep and deep, well drained and somewhat excessively drained soils are on basalt plains. They are nearly level to steep. They formed in sandy windlaid material from mixed sources. They are along the west side of the survey area.

Elevation of these soils is about 4,900 feet and mean annual precipitation is about 10 inches. The mean annual air temperature is about 42 degrees F. and the frost-free period is about 105 days. The soils are mainly used for range.

Two general soil map units in the survey area are in this group. They make up about 8 percent of the survey area.

12. Mathon-Rock outcrop-Modkin

Nearly level to rolling, moderately deep and deep, well drained soils and Rock outcrop

This map unit consists of nearly level to rolling, moderately deep and deep, well drained soils that formed in sandy windlaid material and rock outcrop. Slopes are 0 to 12 percent.

This unit makes up about 7 percent of the survey area. It is about 35 percent Mathon soils, 30 percent Rock outcrop, and 15 percent Modkin soils. The rest is soils of minor extent.

Mathon soils are deep. Typically, the surface layer is brown loamy sand about 5 inches thick. The subsoil is brown sandy loam about 8 inches thick. The upper part of the substratum is brown sandy loam about 42 inches thick. The lower part of the substratum is pale brown, calcareous sandy loam to a depth of more than 60 inches.

Rock outcrops are in a random pattern. Areas of Rock outcrop are 20 to 100 feet across.

Modkin soils are moderately deep. Typically, the surface layer is brown sandy loam about 12 inches thick.

The subsoil is brown sandy loam about 5 inches thick. The substratum is brown, strongly effervescent sandy loam about 5 inches thick over basalt.

The soils of minor extent are deep, coarse textured Grassy Butte soils and shallow, moderately coarse textured Bondranch soils.

The soils in this map unit are almost entirely used for range and wildlife habitat. They provide openland and rangeland habitat for wildlife, such as small mammals, coyotes, antelope, ruffed grouse, and birds of prey. The potential native vegetation consists of big sagebrush, bluebunch wheatgrass, western wheatgrass, and various forbs.

The soils in this unit have limitations for urban development because of soil depth, content of coarse fragments, and the numerous rock outcrops. Rock outcrops and surface stones are the main limitations for recreational facilities.

13. Grassy Butte-Mathon-Rock outcrop

Nearly level to steep, deep, well drained and somewhat excessively drained soils and Rock outcrop

This map unit consists of nearly level to steep, deep, well drained and somewhat excessively drained soils that formed in sandy windlaid material over basalt flows and rock outcrop. Slopes are 0 to 20 percent.

This unit makes up about 1 percent of the survey area. It is about 40 percent Grassy Butte soils, 30 percent Mathon soils, and 25 percent Rock outcrop. The rest is soils of minor extent. Grassy Butte soils are somewhat excessively drained. They are on the sides of volcanic cones. Typically, the surface layer is brown loamy sand about 6 inches thick. The upper part of the underlying material is brown loamy sand about 26 inches thick. The lower part of the underlying material is light brownish gray, strongly effervescent loamy sand to a depth of more than 60 inches.

Mathon soils are at the base of volcanic cones. They are less sloping than Grassy Butte soils. The surface layer is brown sandy loam about 5 inches thick. The subsoil is brown sandy loam about 8 inches thick. The substratum is brown and pale brown sandy loam to a depth of more than 60 inches.

Rock outcrops are in a random pattern on the steeper slopes and around the rims of the volcanic cones. The outcrops range from 20 to 300 feet across.

The soils of minor extent are the shallow, moderately coarse textured Bondranch soils and the moderately deep, moderately coarse textured Modkin soil.

The soils in this map unit are almost entirely used for wildlife habitat. Small areas are used for range. The potential native vegetation consists of big sagebrush, bluebunch wheatgrass, western wheatgrass, and various forbs. These soils provide openland and rangeland habitat for wildlife such as antelope, ruffed grouse, small mammals, coyotes, and birds of prey. Some irrigated cropland is in areas where slopes are less than 12 per-

cent, at the base of the volcanic cones. The main crops are potatoes, wheat, and alfalfa hay.

The soils in this map unit have limitations for urban and recreational development because of rock outcrops and slope. Some areas that are less sloping than others have limited potential for recreational facilities.

Broad land use considerations

Determining which land should be used for urban development is an important issue in the survey area. Each year a considerable amount of land is being developed for urban uses around Rexburg. The population of Rexburg increased from 4,767 in 1965 to 8,665 in 1970. It is estimated that about 11,840 acres, or about 5 percent of the survey area, is urban or built-up land. The general soil map is most helpful for planning the general outline of urban areas, but it cannot be used for the selection of sites for specific urban structures. In general, in the survey area the soils that have good potential for cultivated crops also have good potential for urban development. The data about specific soils in this survey can be helpful in planning future land use patterns.

Areas where the soils are so unfavorable that urban development is prohibitive are not extensive in the survey area. Large areas of the soils in map units 6 and 7 of the general soil map, however, are river bottoms in which flooding and ponding are severe limitations. Also, urban development would be costly on the fine sandy soils in map units 12 and 13 because of soil blowing and bank stabilization. Many areas of the soils in map units 1, 3, and 13 have excessive slopes and hard bedrock at a few feet below the surface. This makes urban development costly and a community sewage system essential. Map unit 7 consists of fine textured soils that have limited potential for urban development because of moderate shrink-swell potential. The soils in map units 7 and 11 are flood plains with intermittent high water tables. In map unit 5 the soils have a thick hardpan a few feet below the surface which necessitates a community sewage system. The soils in map units 1, 2, 4, and 5 have a severe dust problem during and after construction until permanent vegetative cover is established.

In large parts of the area, there are soils that can be developed for urban uses at a lower cost than the soils named earlier. These include areas of soils in map units 8, 9, and 10. The last two of these areas are good cropland, and this should not be overlooked when broad land uses are considered.

Potatoes are well suited to soils in map units 4 and 5 if sprinkler irrigated and are well suited to soils in unit 11 if subirrigated. The soils in map unit 2 are well suited to seed potato production. Nonirrigated wheat is well suited to soils in map units 4 and 5 and the higher elevated soils in map unit 1. Irrigated barley, wheat, oats, alfalfa, and pasture are well suited to soils in map units 7, 8, 9, 10, and 11. Some areas of the soils in map unit 6 are

also suitable for these crops. Some trees are cut on the soils in map unit 3 for use as posts and poles.

The hilly soils in map units 2, 3, 4 and 5 have potential as sites for parks and extensive recreation areas. Several parks and recreation areas are currently being used on the river bottom soils of map units 6; 7, 8, 9, and 10. All of these map units provide habitat for many species of wildlife.

Soil maps for detailed planning

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Rexburg silt loam, 2 to 4 percent slopes, is one of several phases in the Rexburg series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Grassy Butte-Mathon complex, 0 to 20 percent slopes is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and

relative proportion of the soils are somewhat similar. There are no associations in this survey.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. There are no undifferentiated groups in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

1-Annis silty clay loam. This nearly level, deep, moderately well drained soil is on river terraces. It formed in mixed alluvium. Slopes are 0 to 1 percent. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is grayish brown; the upper 7 inches is silty clay loam, and the lower 5 inches is silt loam. The subsoil is light brownish gray silt loam about 9 inches thick. The upper part of the substratum is light brownish gray and gray, mottled silty clay loam about 17 inches thick. The lower part of the substratum is gray and light gray, mottled silty clay loam and silt loam to a depth of more than 60 inches. The soil is effervescent and moderately alkaline throughout.

Included with this soil in mapping are small areas of Blackfoot silt loam, Withers silty clay loam, and Annis soil with a silt loam surface layer; all with slopes of 0 to 1 percent. Also included are areas just north of Rexburg, in sections 17 and 18, T. 6 N., R. 40 E. that have a high water table fluctuating between a depth of 2 to 4 feet.

Permeability of this Annis soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight. A water table is at a depth of 3 to 5 feet from summer to early in fall.

This soil is used for irrigated hay, wheat, barley, pasture, and potatoes. When properly managed, this soil

produces good yields of all adapted crops. A good conservation program includes an adequate crop rotation and suitable fertilization and weed control programs. Suitable rotation includes pasture or alfalfa hay for 4 to 6 years, then grain for 2 years with pasture or alfalfa seeded back into the second year grain stubble. When potatoes are grown, they generally are included in the alternate year rotation with a grain crop.

Application rates of the irrigation water need to be tailored to the moderately slow permeability of this Annis soil. Care should be exercised in applying irrigation water to avoid adding to the water table. Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Furrow irrigation is used where potatoes are grown. Sprinkler irrigation is suitable for all crops, but it is not currently widely used.

Permeability and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tanks and filter fields. Low strength limits the use of this soil for dwellings and small commercial buildings. Designs for these structures should compensate for the inability of this soil to support a load that could result in shifting and cracking of foundations or walls. The fluctuating water table is at a depth of 3 to 5 feet for short periods in summer or early in fall unless the soil is drained. This water table should also be considered in the construction of septic tank absorption fields and dwellings with basements.

This soil is in capability subclass IIc irrigated.

2-Ard silt loam, 4 to 12 percent slopes. This moderately deep, well drained soil is on dissected plateaus. It formed in loess that is over and mixed with residuum of rhyolite. Elevation is about 6,100 feet. The mean annual precipitation is about 15 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 80 days.

Typically, the surface layer is dark grayish brown and grayish brown silt loam about 12 inches thick. The underlying material is white, violently effervescent, flaggy silt loam and grayish brown, violently effervescent, flaggy loam about 13 inches thick over fractured rhyolitic tuff. Depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are small areas of Karlan silt loam, Ririe silt loam, and Tetonia silt loam; all with slopes of 4 to 12 percent. Also included are small areas of Ard soils with slopes less than 4 percent and more than 12 percent.

Permeability of this Ard soil is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is mainly used for nonirrigated barley and winter wheat. Some areas, however, are used for range, and a few small areas are used for nonirrigated hay and pasture. If this soil is properly managed, it produces good yields of all adapted crops. A good conservation

program is one that includes an adequate crop rotation and suitable fertilizer and weed control programs. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture. Only small areas of this soil are currently irrigated; however, most areas are suited to sprinkler irrigation.

This Ard soil is also used for range and wildlife habitat. The potential native vegetation consists mainly of mountain big sagebrush, bluebunch wheatgrass, Idaho fescue, and Nevada bluegrass. When the range condition deteriorates, the plants most likely to invade or increase are sagebrush, rabbitbrush, cheatgrass, Russian-thistle, and needlegrass. A planned grazing system, brush management, a reseeding program, water development, and fencing to control grazing help to maintain range condition. Species commonly used for reseeding are bluebunch wheatgrass, Siberian wheatgrass, and intermediate wheatgrass.

Depth to bedrock is the main limitation for urban development. The location of septic tanks and movement of leachates from filter fields are restricted by underlying bedrock. Roads or streets should be designed to avoid damage resulting from frost action.

This soil is in capability subclass IVe nonirrigated.

3-Ard flaggy silt loam, 4 to 12 percent slopes.

This moderately deep, well drained soil is on dissected plateaus. It formed in silty windlaid material that is over and mixed with residuum of rhyolite or rhyolitic tuff. Elevation is about 6,100 feet. The mean annual precipitation is about 15 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 80 days.

Typically, the surface layer is dark grayish brown and grayish brown, flaggy silt loam about 12 inches thick. The underlying material is white, violently effervescent, flaggy silt loam and grayish brown, violently effervescent, flaggy loam about 13 inches thick over fractured rhyolitic tuff. Depth to bedrock ranges from 20 to 40 inches. Ten to 30 percent coarse fragments are throughout the profile.

Included with this soil in mapping are small areas of Karlan silt loam, Ririe silt loam, and Tetonia silt loam; all with slopes of 4 to 12 percent. Also included are small areas of Ard soils with slopes less than 4 percent and more than 12 percent.

Permeability of this Ard soil is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is almost entirely used for range. Nonirrigated winter wheat, barley, hay, and pasture are grown in some areas.

The potential native vegetation consists mainly of mountain big sagebrush, Idaho fescue, bluebunch wheat-

grass, and Nevada bluegrass. When the range deteriorates, the plants most likely to invade or increase are cheatgrass, Russian-thistle, and annual forbs. A planned grazing system, brush management, reseeding, water development, and fencing to control grazing help to maintain range condition. Species commonly used for reseeding are bluebunch wheatgrass, Siberian wheatgrass, and intermediate wheatgrass.

Depth to bedrock is the main limitation for urban development. The location of septic tanks and movement of leachates from filter fields are restricted by underlying bedrock. This factor should also be considered when locating sites for dwellings with basements. Roads or streets should be designed to avoid damage resulting from frost action. Surface stones are the main limitation for recreational development.

This soil capability subclass IIVe nonirrigated.

4-Bannock loam. This deep, well drained soil is on river terraces. It formed in mixed alluvium and is moderately deep to sand and gravel. Slopes are 0 to 1 percent. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is grayish brown loam about 7 inches thick. The subsoil is grayish brown and light brownish gray loam about 8 inches thick. The substratum is white silt loam and light brownish gray gravelly loam about 10 inches thick over loose sand and gravel to a depth of more than 60 inches. Depth to the underlying sand and gravel ranges from 20 to 40 inches.

Included with this soil in mapping are small areas of Bockston loam and Wardboro gravelly loam and gravelly sandy loam; all with slopes of 0 to 1 percent.

Permeability of this Bannock soil is moderate in the layers above the sand and gravel and is very rapid in the sand and gravel. Effective rooting depth is more than 60 inches. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, spring wheat, barley, potatoes, and pasture. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation would include pasture or alfalfa hay for 4 to 6 yrs. and grain, for 2 yrs. with

pasture or alfalfa seeded back into the second year of grain stubble. When potatoes are grown, they are generally included in an alternate year rotation with grain crops.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Furrow irrigation is used where potatoes are grown. Sprinkler irrigation is suitable for all crops, but it is not widely used.

Very rapid permeability of the underlying sand and gravel is a limitation for sewage lagoons. Lagoons

should be designed to prevent seepage that could pollute underground water sources. This factor also limits the choice of locations for sanitary landfills. Roads or streets should be designed to avoid the damage resulting from frost action.

This soil is in capability subclass IIs irrigated.

5-Blackfoot silt loam. This deep, somewhat poorly drained soil is on river terraces and flood plains. It formed in mixed alluvium. Slopes are 0 to 1 percent. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is grayish brown silt loam about 10 inches thick. The upper part of the underlying material is light brownish gray, mottled silt loam and silty clay loam 25 inches thick. The lower part of the underlying material is stratified, mottled silt loam; silty clay loam; and sandy loam to a depth of about 60 inches.

Included with this soil in mapping are small areas of Annis silty clay loam, Labenzo silt loam, Withers clay loam, and a soil similar to the Blackfoot soil that has a light gray surface layer; all with slopes of 0 to 1 percent.

Permeability of this Blackfoot soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight. A water table is at a depth of 2 to 4 feet in summer and early in spring.

This soil is used for irrigated hay, spring wheat, barley, pasture, and potatoes. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation includes pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa seeded back into the second year of grain stubble. When potatoes are grown, they are generally included in an alternate year rotation with grain crops.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Furrow irrigation is used where potatoes are grown. Sprinkler irrigation is suitable for all crops, but it is not widely used.

This soil has limitations for urban development. The high water table reduces the effectiveness of septic tank filter fields. This soil has relatively low strength for dwellings and small commercial buildings. Designs for these structures should compensate for the inability of the soil to support a load that could result in shifting and cracking of foundations or walls. Roads or streets should be designed to avoid the damage resulting from frost action.

A fluctuating water table is at a depth of about 2 to 4 feet for short periods in summer or early in fall unless the soil is drained. Surface and subsurface drainage should be used to reduce the water table problem.

This soil is in capability subclass IIw irrigated.

6-Bockston loam. This deep, well drained soil is on terraces of rivers. It formed in mixed alluvium and is deep to sand and gravel. Slopes are 0 to 1 percent. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 42 degrees F.; and the frost-free period is about 105 days.

Typically, the surface layer is grayish brown loam about 10 inches thick. The subsoil is pale brown loam about 11 inches thick. The upper part of the substratum is pale brown, strongly effervescent loam about 8 inches thick. The lower part of the substratum is white, violently effervescent silt loam and fine sandy loam about 21 inches thick over loose sand, gravel, and cobbles to a depth of more than 60 inches. Depth to the underlying sand and gravel ranges from 44 to 50 inches.

Included with this soil in mapping are small areas of Bannock loam, Heiseton loam, and Wardboro loam; all with slopes of 0 to 1 percent. Also included are small areas of Bockston soil with a silt loam and sandy loam surface layer.

Permeability of this Bockston soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, spring wheat, barley, potatoes, and pasture. Sugar beets are grown on a very small acreage of this Bockston soil. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation would include pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa seeded back into the second year grain stubble. When potatoes are grown, they are generally included in an alternate year rotation with grain crops. The grazing management program for pasture should provide a rotation grazing system during the growing season and should establish a minimum height at which plants are to be grazed.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Furrow irrigation is used where potatoes are grown. Sprinkler irrigation is suitable for all crops, but it is not widely used.

Very rapid permeability of the underlying sand and gravel is a limitation for sewage lagoons. Lagoons should be designed to prevent seepage that could pollute underground water sources. This factor should also be considered when locating sites for sanitary landfills. Roads or streets should be designed to avoid damage resulting from frost action.

This soil is in capability subclass IIc irrigated.

7-Eginbench loamy coarse sand, wet. This deep, somewhat poorly drained soil is on terraces of the Snake River. It formed in alluvium derived from mixed sources.

Slopes are 0 to 1 percent. Elevation is about 4,900 feet.

The mean annual precipitation is about 11 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is brown loamy coarse sand about 8 inches thick. The upper part of the underlying material is brown and light brownish gray loamy coarse sand about 31 inches thick with faint and distinct mottles. The lower part of the underlying material is pale brown coarse sand to a depth of more than 60 inches.

Included in mapping are small areas of Grassy Butte loamy sand. Slopes are less than 2 percent.

Permeability of this Eginbench soil is rapid in the upper part and very rapid in the coarse sand. Effective rooting depth is more than 60 inches. Available water capacity is low. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is high. A water table caused by subirrigation is at a depth of 12 to 36 inches.

Irrigated hay, potatoes, spring wheat, barley, and pasture are grown on this soil. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation would include pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa seeded back into the second year grain stubble. When potatoes are grown, they are generally included in an alternate year rotation with grain crops.

Subirrigation is the most common irrigation method for crops on this soil, although some sprinklers are used (fig. 8). As more of this soil is sprinkler irrigated, the water table is lowered.

This soil has limitations for urban development. Effluent from septic tank absorption fields could easily contaminate underground water sources because of shallow depth to the water table. Shallow depth to the water table is also a limitation for construction of dwellings. This soil is suitable for septic systems in the small areas that are not subirrigated. The content of sand creates a hazard of cutbanks caving in shallow excavations.

This soil is in capability subclass IIw irrigated.

8-Grassy Butte loamy sand, 2 to 4 percent slopes.

This deep, somewhat excessively drained soil is on basalt plains. It formed in sandy windlaid material derived from mixed sources. Elevation is about 4,900 feet. The mean annual precipitation is about 10 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is brown loamy sand about 6 inches thick. The upper part of the underlying material is light brownish gray, strongly effervescent loamy sand about 26 inches thick. The lower part of the, underlying material is light brownish gray, strongly effervescent loamy sand about 30 inches thick over basalt. Depth to bedrock is more than 60 inches.

Included with this soil in mapping are small areas of

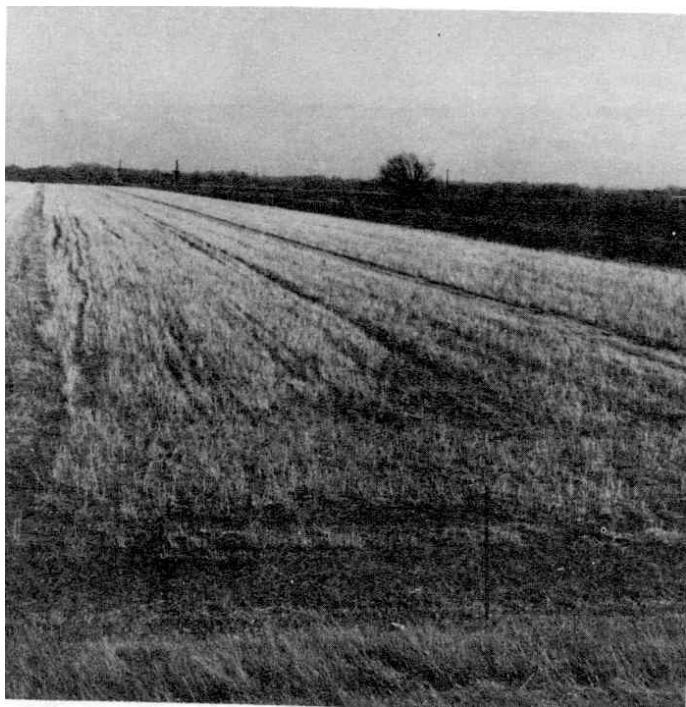


Figure 8.-Improved irrigation water management on the Eginbench soil achieved by converting to sprinkler irrigation.

Mathon sandy loam, Modkin sandy loam, and small areas of Grassy Butte sand; all with slopes of 0 to 4 percent, and rock outcrops. Also included are small areas of a soil similar to the Grassy Butte soil but which are 20 to 40 inches deep to bedrock and areas with slopes more than 4 percent.

Permeability of this Grassy Butte soil is rapid. Effective rooting depth is more than 60 inches. Available water capacity is low. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is high.

This soil is used for range, wildlife habitat, and recreation. A few areas are used for irrigated cropland.

The potential native vegetation consists mainly of bluebunch wheatgrass, Indian ricegrass, needleandthread grass, sand dropseed, antelope bitterbrush, and big sagebrush. When the range condition deteriorates, the plants most likely to invade or increase are big sagebrush, rabbitbrush, cheatgrass, Russian-thistle, and needlegrass. A planned grazing system, brush management, water development, and fencing to control grazing help to maintain range condition. Seeding is advisable only if needed to stabilize soil blowing. Crested wheatgrass, Siberian wheatgrass, Indian ricegrass, and needlegrass are suitable for seeding. The grass selected should be suitable for grazing in spring and late in fall.

Though this Grassy Butte soil is mainly used for range, most areas are suited to sprinkler irrigated crops. The main crops are potatoes, spring wheat, barley, and alfalfa hay. The high hazard of soil blowing should be considered with any tillage practice used.

If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation would include alfalfa hay for 4 to 6 years and grain for 2 years, with alfalfa seeded back into the second year grain stubble. When potatoes are grown, they are generally included in an alternate year rotation with grain crops. Sprinkler irrigation is the most widely used method.

Urban development is limited mainly by the loamy sand texture. Cutbanks cave easily in this loamy sand soil. The surface layer should be protected during the establishment of lawns to avoid soil loss by soil blowing.

This soil is in capability subclass VIIe nonirrigated and IVE irrigated.

9-Grassy Butte loamy sand, 4 to 20 percent slopes. This deep, somewhat excessively drained soil is on basalt plains. It formed in sandy windlaid material derived from mixed sources. Elevation is about 4,900 feet. The mean annual precipitation is about 10 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is brown loamy sand about 6 inches thick. The upper part of the underlying material is brown loamy sand about 26 inches thick. The lower part of the underlying material is light brownish gray, strongly effervescent loamy sand about 30 inches thick, over basalt. Depth to bedrock is more than 60 inches.

Included with this soil in mapping are small areas of Bondbranch extremely stony sandy loam with slopes of 4 to 20 percent, Rock outcrop, and a soil similar to the Grassy Butte soil but which is 20 to 40 inches deep to bedrock. Also included are small areas of soils with slopes less than 4 percent.

Permeability of this Grassy Butte soil is rapid. Effective rooting depth is more than 60 inches. Available water capacity is low. Surface runoff is slow or medium, and the hazard of erosion is slight to moderate. The hazard of soil blowing is high.

This soil is used for range, wildlife habitat, and recreation. The potential native vegetation consists mainly of bluebunch wheatgrass, Indian ricegrass, needleandthread grass, sand dropseed, antelope bitterbrush, and big sagebrush. When the range condition deteriorates, the plants most likely to invade or increase include rabbitbrush, big sagebrush, cheatgrass, Russian-thistle, and needlegrass.

A planned grazing system, brush management, water development, and fencing to control grazing help to maintain range condition. Reseeding of this soil is impractical, except where it is used to stabilize soil blowing.

Suitable species for reseeding are crested wheatgrass, Siberian wheatgrass, needlegrass, and Indian ricegrass.

Irrigation is not presently being used, but this soil is suited to sprinkler irrigation on areas with slopes less than 8 percent. Potential irrigated crops are potatoes, spring wheat, barley, and alfalfa hay. The hazard of soil blowing should be considered with any tillage practice used.

The loamy sand texture and slope of more than 8 percent are limitations for urban development. Cutbanks cave easily in this loamy sand soil. The surface layer should be protected during the establishment of lawns to prevent soil blowing. Septic tank absorption fields need modified designs if located on slopes of more than 8 percent.

This soil is in capability subclass VIIe nonirrigated and IVe irrigated.

10-Grassy Butte-Mathon complex, 0 to 20 percent slopes. This complex is on basalt plains. The soils formed in mixed, sandy windblown material. Elevation is about 5,000 feet. The mean annual precipitation is about 10 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

This complex is about 50 percent Grassy Butte loamy sand and 25 percent Mathon loamy sand. The remaining 25 percent is Modkin sandy loam, Bondbranch very stony sandy loam, and a soil similar to the Mathon soil but which has lime accumulation at a depth of about 30 inches.

The Grassy Butte soil is deep and somewhat excessively drained. Typically, the surface layer is brown loamy sand about 6 inches thick. The upper part of the underlying material is brown loamy sand about 26 inches thick. The lower part of the underlying material is light brownish gray loamy sand about 30 inches thick over basalt. Depth to bedrock is more than 60 inches.

Permeability of this Grassy Butte soil is rapid. Effective rooting depth is more than 60 inches. Available water capacity is low. Runoff is very slow to medium, and the hazard of erosion is slight or moderate. The hazard of soil blowing is high.

The Mathon soil is deep and well drained. Typically, the surface layer is brown loamy sand about 5 inches thick. The subsoil is brown sandy loam about 8 inches thick. The substratum is brown and pale brown sandy loam to a depth of more than 60 inches.

Permeability of the Mathon soil is moderately rapid. Effective rooting depth is more than 60 inches. Available water capacity is moderate. Surface runoff is slow to medium, and the hazard of erosion is slight or moderate. The hazard of soil blowing is high.

The soils in this complex are used for irrigated cropland, range, wildlife habitat, and recreation. The main crops are alfalfa hay, spring wheat, barley, and potatoes. If properly managed, these soils produce fair yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertiliza

tion and weed control programs. A suitable rotation would include alfalfa hay for 4 to 6 years and grain for 2 years, with alfalfa seeded back into the second year grain stubble. When potatoes are grown, they are generally included in an alternate year rotation with grain crops.

Sprinkler irrigation is the most widely used method on these soils. Areas with slopes of more than 8 percent are questionable for irrigation.

The potential native vegetation consists mainly of bluebunch wheatgrass, Indian ricegrass, needleandthread grass, sand dropseed, western wheatgrass, antelope bitterbrush, and big sagebrush. When the range condition deteriorates, the plants most likely to invade or increase are rabbitbrush, big sagebrush, cheatgrass, Russian-thistle, and needlegrass. A planned grazing system, brush management, water development, and fencing to control grazing help to maintain range condition. Reseeding of these soils is impractical, except where it is needed to stabilize soil blowing. Suitable species for seeding are crested wheatgrass, Siberian wheatgrass, Indian ricegrass, and needlegrass.

Coarse textures, rapid permeability, and slopes are the main limitations for structural and recreational development. The rapid permeability of these soils creates a hazard of seepage from the sewage lagoons. Cutbanks cave easily in these loamy sand soils. The sandy surface layer is a limitation for recreational facilities, and soil blowing is a hazard when the soils are subjected to heavy foot traffic.

This complex is in capability subclass IVe irrigated and VIIe nonirrigated.

11-Grassy Butte-Rock outcrop complex, 2 to 20 percent slopes. This map unit is on basalt plains. The soil formed in sandy windlaid material derived from mixed sources. Elevation is about 4,900 feet. The mean annual precipitation is about 10 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

This complex is about 40 percent Grassy Butte very stony loamy sand with slopes of 2 to 20 percent and about 30 percent Rock outcrop. Included in mapping is about 30 percent Bondbranch very stony sandy loam, Mathon loamy sand, and a soil similar to the Grassy Butte soil but which is 20 to 60 inches deep to bedrock. The included soils have slopes of 2 to 20 percent.

The Grassy Butte soil is deep and somewhat excessively drained. Typically, the surface layer is brown very stony loamy sand about 6 inches thick. The upper part of the underlying material is brown loamy sand about 26 inches thick. The lower part of the underlying material is light brownish gray, strongly effervescent loamy sand about 30 inches thick over basalt. Depth to bedrock is more than 60 inches. Some profiles mapped near rock outcrops contain up to 75 percent basalt fragments.

Permeability of this Grassy Butte soil is rapid. Effective rooting depth is more than 60 inches. Available water

capacity is low. Surface runoff is very slow to medium, and the hazard of erosion is slight or moderate. The hazard of soil blowing is high.

Rock outcrops are in a random pattern, are 20 to 100 feet across, and have irregular shapes.

The soils in this complex are used for range, wildlife habitat, and recreation. The potential native vegetation consists mainly of bluebunch wheatgrass, Indian ricegrass, needleandthread grass, sand dropseed, antelope bitterbrush, and big sagebrush. When the range condition deteriorates, the plants most likely to invade or increase are rabbitbrush, big sagebrush, cheatgrass, Russian-thistle, and needlegrass. A planned grazing system, brush management, water development, and fencing to control grazing help to maintain range condition. Reseeding of these soils is impractical because of the numerous rock outcrops and surface stones.

The numerous rock outcrops, the loamy sand surface layer, 10 to 25 percent stones in the surface layer, and slope are the main limitations for urban uses. Cutbanks cave easily in these loamy sand soils. Rock outcrops need to be avoided when selecting housing sites, otherwise problems could arise when footings and septic tank absorption fields are installed. Soils left unprotected during the establishment of lawns could be damaged by soil blowing.

This complex is in capability subclass VIIs nonirrigated.

12-Greys silt loam, 12 to 20 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty, windlaid material. Elevation is 5,700 to 7,000 feet. The mean annual precipitation is about 20 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 60 days.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 4 inches thick. The lower part of the surface is brown silt loam about 12 inches thick. The subsurface layer is pale brown silt loam about 7 inches thick. The subsoil is light yellowish brown silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Lantonia silt loam, Ririe silt loam, Tetonia silt loam, and Turnerville silt loam; all of which have slopes of 0 to 20 percent. Also included are small areas of Greys soil with slopes of less than 12 percent.

Permeability of this Greys soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used for wildlife habitat, recreation, and range. Some areas have been cleared and are being used for nonirrigated winter wheat and barley.

A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture.

The potential native vegetation consists mainly of blue wildrye, mountain brome grass, pine reedgrass, slender wheatgrass, and quaking aspen. When the condition of the range deteriorates, the plants most likely to invade or increase are annual grasses, annual forbs, Russian-thistle, and rabbitbrush. A planned grazing system, brush management, a reseeding program, water development, and fencing to control grazing help to maintain range condition.

Slope and the hazard of frost damage are the main limitations for urban development. Roads and streets should be designed to prevent frost damage. Septic tank absorption fields should be designed to allow for the moderate permeability and the slope of the soil.

Slope is the main limitation for all uses. Use of this soil should be kept to a minimum in order to maintain the aesthetic value of the natural vegetation. This soil has limited potential for camp areas, picnic areas, and paths and trails. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic.

This soil is in capability subclass IVe nonirrigated.

13-Greys slit loam, 20 to 30 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation ranges from 5,700 to 7,000 feet. The mean annual precipitation is about 20 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 60 days.

Typically, the upper part of the surface layer is dark grayish brown silt loam about 4 inches thick. The lower part of the surface layer is brown silt loam about 12 inches thick. The subsurface layer is pale brown silt loam about 7 inches thick. The subsoil is light yellowish brown silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Rammel stony loam, Tetonia silt loam, and Turnerville silt loam; all with slopes of 20 to 30 percent. Also included are small areas with slopes more than 30 percent. Some pedons have up to 10 percent stones.

Permeability of this Greys soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is rapid, and the hazard of erosion is high.

This soil is used for wildlife habitat, recreation, and range. The slopes are too irregular and steep to be cultivated. The potential native vegetation consists mainly of blue wildrye, mountain brome grass, slender wheatgrass, pine reedgrass, and quaking aspen. When the range condition deteriorates, the plants most likely to invade or increase are annual grasses, annual forbs, and Russian-thistle. A planned grazing system, brush management, water development, and fencing to control grazing help to maintain range condition.

Slope and the hazard of frost damage are the main limitations for urban development. Roads and streets need to be designed to prevent frost damage. It is difficult to locate a site for septic tank filter fields on the

moderately steep areas. Slope should be a consideration in the design of dwellings.

This soil has limited potential for paths and trails. Use of this soil should be kept to a minimum in order to maintain the aesthetic value of the natural vegetation. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic. Slope should also be a consideration in the location of paths and trails.

This soil is in capability subclass IVe nonirrigated.

14-Haplaquolls, channeled. These deep, poorly drained or very poorly drained soils are on river flood plains near the Teton and Snake Rivers. They formed in alluvium. Slopes are 0 to 1 percent. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Included with these soils in mapping are small areas of Annis silty clay loam, Withers silty clay loam, and Labenzo silt loam; all with slopes of 0 to 1 percent. Also included are small exposed areas of sand or gravel and areas that are moderately well drained or somewhat poorly drained.

Color of the soil material over sand and gravel varies greatly. Texture varies from fine to medium. Depth to sand and gravel commonly ranges from 20 to 40 inches, but in some places it is as much as 60 inches.

The surface is ponded 1 or 2 months in spring. The hazard of erosion is slight. Channels about 2 feet deep are at about 50 feet intervals. They are about 15 feet wide.

These soils are mainly used for wildlife habitat, recreation, and native grassland (fig. 9). A few areas that have better drainage are cultivated and used for small grain and seeded pasture.

The main limitation for recreational development is wetness. Dwellings and local streets and roads should be designed to offset low strength. The possibility of damage to roads by frost action should also be considered. Effluent from septic tank absorption fields could easily contaminate underground water sources because of the shallow depth to the water table.

These soils are in capability subclass Vw.

15-Harston coarse sandy loam, 0 to 2 percent slopes. This deep, well drained soil is on river terraces. It formed in mixed river alluvium derived mainly from basalt, rhyolite, and andesite from the Henrys Fork of the Snake River, with some influence from sandy, windlaid material. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is light brownish gray coarse sandy loam about 8 inches thick. The upper part of the underlying material is brown coarse sandy loam about 16 inches thick. The lower part of the underlying material is light gray coarse sandy loam about 4 inches



Figure 9.-This area of Haplaquolls, channeled, is used for grazing and wildlife habitat.

thick over coarse sand and fine gravel to a depth of 60 inches. This soil is on higher terraces and contains a greater percentage of fine gravel than is typical.

Included with this soil in mapping are small areas of Bannock loam and Wardboro gravelly sandy loam, both with slopes of 0 to 1 percent. Also included are areas of this Harston soil that have a loam surface layer and areas with slopes of 2 to 4 percent. Most areas of this Harston soil contain angular basaltic gravel in the underlying material.

Permeability of this Harston soil is moderately rapid in the upper part and very rapid in the sand and gravel. Effective rooting depth is more than 60 inches. Available water capacity is low. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

This soil is used for irrigated hay, spring wheat, barley, potatoes, and pasture. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation would include pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa seeded back into the second year grain stubble. When potatoes are grown, they are generally included in an alternate year rotation with grain crops.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Furrow irrigation is used where potatoes are grown. Sprinkler irrigation is suitable for all crops, but it is not widely used.

The very rapid permeability of the underlying sand and gravel is a limitation for sewage lagoons. Lagoons should be designed to prevent seepage that could pollute underground water sources. Some smaller housing developments are being placed on this Harston soil. The moderately rapid permeability can cause pollution of underground water by septic tanks if the concentration of housing becomes too great. The content of sand and gravel below a depth of 30 inches creates a hazard of cutbanks caving in shallow excavations.

This soil is in capability subclass III_s irrigated.

16-Harston sandy loam, 0 to 1 percent slopes.

This deep, well drained soil is on river terraces. It formed in mixed alluvium. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is light brownish gray sandy loam about 8 inches thick. The upper part of the underlying material is light brownish gray sandy loam about 16 inches thick. The lower part of the underlying material is light gray loamy sand about 4 inches thick over loose sand and gravel to a depth of more than 60 inches. The depth to sand and gravel ranges from 25 to 40 inches. In some profiles the lower part of the underlying material is sandy loam or gravelly sandy loam.

Included with this soil in mapping are small areas of Bannock loam, Heiseton loam, and Wardboro gravelly loam; all with slopes of 0 to 1 percent. Also included are small areas of Harston gravelly sandy loam.

Permeability of this Harston soil is moderately rapid in the upper part and very rapid in the sand and gravel. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

This soil is used for irrigated hay, spring wheat, barley, pasture, and potatoes. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation would include pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa seeded back into the second year grain stubble. When potatoes are grown, they are generally included in an alternate year rotation with grain crops.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Furrow irrigation is used where potatoes are grown. Sprinkler irrigation is suitable for all crops, but it is not widely used.

The very rapid permeability of the underlying sand and gravel is a limitation for sewage lagoons. Lagoons should be designed to prevent seepage through the floor and embankments, which could pollute underground water sources. Some smaller housing developments are being placed on this Harston soil. The moderately rapid permeability can cause pollution of underground water by septic tanks if the concentration of housing becomes too great. The content of sand and gravel below a depth of 30 inches creates a hazard of cutbanks caving in shallow excavations.

This soil is in capability subclass III_s irrigated.

17-Harston gravelly sandy loam, 0 to 1 percent slopes. This deep, well drained soil is on river terraces. It formed in mixed alluvium from the Snake River and its tributaries. Elevation is about 4,800 feet. The mean annual precipitation is, about 12 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is light brownish gray gravelly sandy loam about 8 inches thick. The upper part of the underlying material is light brownish gray gravelly sandy loam about 16 inches thick. The lower part of the underlying material is light gray, gravelly loamy sand about 4 inches thick over sand and gravel. Depth to the sand and gravel ranges from 25 to 40 inches. The lower part of the underlying material is gravelly sandy loam in some profiles.

Included with this soil in mapping are small areas of Bannock loam, Labenzo gravelly loam, Wardboro gravelly loam, and Wardboro gravelly sandy loam; all with slopes of 0 to 1 percent. Also included are small areas of this Harston soil that have a nongravelly surface layer.

Permeability of this Harston soil is rapid. Effective rooting depth is more than 60 inches. Available water capacity is low. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

This soil is used for irrigated alfalfa hay, spring wheat, barley, pasture, and potatoes. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation would include pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa seeded back into the second year of grain stubble. When potatoes are grown, they are generally included in an 'alternate year rotation with grain crops.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Furrow irrigation is used where potatoes are grown. Sprinkler irrigation is suitable for all crops but is not widely used.

The very rapid permeability of the underlying sand and gravel is a limitation for sewage lagoons. Lagoons should be designed to prevent seepage that could pollute underground water sources. Some smaller housing

developments are being placed on this Harston soil. The rapid permeability can cause pollution of underground water by septic tanks if the concentration of housing becomes too great. The content of sand and gravel below a depth of 30 inches creates a hazard of cutbanks caving in shallow excavations. Gravel on the surface of this soil is a limitation for recreation facilities.

This soil is in capability subclass IIIs irrigated.

18-Heiseton loam. This deep, moderately well drained soil is on river terraces. It formed in mixed alluvium from the Snake River and its tributaries. Slopes are 0 to 1 percent. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is light brownish gray loam about 6 inches thick. The underlying material to a depth of 60 inches is pale brown and light brownish gray, stratified loamy sand, loam, sandy clay loam, and coarse sand. Mottles are common below a depth of 20 inches. A water table is at a depth of 4 to 6 feet late in spring and in summer. Some areas are underlain by sand and gravel at a depth of 40 to 50 inches.

Included with this soil in mapping are small areas of Bockston loam, Harston sandy loam, and Wardboro gravelly sandy loam and gravelly loam; all with slopes of 0 to 1 percent. Also included are small areas of a Heiseton soil that has a sandy loam surface layer.

Permeability of this Heiseton soil is moderately rapid. Effective rooting depth is more than 60 inches. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight.

These soils are used for irrigated hay, spring wheat, barley, potatoes, and pasture. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation would include pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa seeded back into the second year grain stubble. When potatoes are grown, they are generally included in an alternate year rotation with grain crops.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Furrow irrigation is used where potatoes are grown. Sprinkler irrigation is suitable for all crops, but it is not widely used.

The high water table and the moderately rapid permeability are the main limitations for urban development. The fluctuating water table can cause failure of septic tank absorption fields. Sewage lagoons need an impervious lining of the bottom and banks to prevent seepage that could contaminate underground water sources. Local roads and streets should be designed to minimize frost damage.

This soil is in capability subclass IIs irrigated.

19-Judkins extremely stony loam, 30 to 60 percent slopes. This moderately deep, well drained soil is on mountainsides. It formed in material weathered from rhyolitic bedrock. Elevation is 5,800 to 7,000 feet. The mean annual precipitation is about 22 inches, the mean annual air temperature is about 37 degrees F., and the frost-free period is about 60 days.

Typically, the surface layer is light brownish gray, extremely stony loam about 6 inches thick. The subsurface layer is light gray, extremely stony loam about 4 inches thick. The subsoil is pale brown, extremely stony loam about 25 inches thick over fractured rhyolitic bedrock. Depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are small areas of Greys silt loam with slopes of 20 to 30 percent and Turnerville silt loam with slopes of 2 to 20 percent. Also included along Moody Creek and surrounding drainageways, are small areas of wet, fine textured soil with slopes of 0 to 4 percent.

Permeability of this Judkins soil is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is very low. Surface runoff is rapid, and the hazard of erosion is high.

This soil is used for wildlife habitat. Most areas are densely covered with lodgepole pine and Douglas-fir. Because of the isolated location, the timber is not harvested for commercial use.

The content of stones in the profile, steep slopes, and depth to bedrock are the main limitations for homesites and sanitary facilities. The high percentage of large stones and steep slopes are the main limitations considered in the construction of local streets and roads.

The main recreational use is for paths and trails. Steep slopes and the percentage of large stones severely limit the use of this soil for camp areas, picnic areas, and playgrounds.

This soil is in capability subclass VIIIs nonirrigated.

20-Karlan silt loam, 4 to 12 percent slopes. This moderately deep, well drained soil is on dissected plateaus. It formed in thin, silty windlaid material and colluvium over material weathered from rhyolite and rhyolitic tuff. Elevation ranges from 5,700 to 7,000 feet. The mean annual precipitation is about 17 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 60 days.

Typically, the surface layer is dark grayish brown silt loam about 17 inches thick. The subsoil is dark brown and brown silt loam about 11 inches thick. The substratum is white, violently effervescent gravelly loam about 3 inches thick over fractured rhyolite tuff. Depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are small areas of Ard silt loam with slopes of 4 to 12 percent, Tetonia silt loam with slopes of 4 to 8 percent, and Rammel very stony loam with slopes of 8 to 20 percent. Also included are small areas of Karlan silt loam with slopes of more than 12 percent.

Permeability of this Karlan soil is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is mainly used for nonirrigated wheat. Some barley and alfalfa hay are also grown. Nonirrigated small grain is used in an alternating grain-fallow rotation. The rest of the acreage is used for range. This soil is not currently irrigated, but areas with slopes less than 8 percent are suited to sprinkler irrigation.

Potential native vegetation consists mainly of Idaho fescue, bluebunch wheatgrass, and mountain big sagebrush. When the range condition deteriorates, the plants most likely to invade or increase are cheatgrass, Russian-thistle, and annual forbs. A planned grazing system, brush management, a reseeding program, water development, and fencing to control grazing help to maintain range condition. Bluebunch wheatgrass, brome grass, and antelope bitterbrush are suitable for seeding. The grass selected should be suitable for summer and fall grazing.

Depth to bedrock and slope are the main limitations for urban development. Dwellings built on these slopes need special designs. Choosing sites for septic tank filter fields is also difficult on these slopes.

This soil is in capability subclass IVe nonirrigated and irrigated.

21-Labenzo gravelly loam. This nearly level, deep, moderately well drained soil is on river terraces and flood plains. Slopes are 0 to 1 percent. This soil formed in mixed alluvium derived from the Snake River and its tributaries. It is moderately deep to sand and gravel. Elevation is about 4,800 feet. The mean annual precipitation is about 11 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is grayish brown gravelly loam about 13 inches thick. The underlying material is stratified, pale brown; light brownish gray; and dark gray gravelly loam about 21 inches thick over sand and gravel to a depth of more than 60 inches.

Some areas are nongravelly below the surface layer, but most contain 15 to 25 percent gravel throughout the profile. Some profiles contain strata of silt loam and silty clay loam. The soil is slightly effervescent throughout. Mottles are common below a depth of 17 inches. A water table is at a depth of 36 to 60 inches in summer and early in fall.

Included with this soil in mapping are small areas of Blackfoot silt loam, Harston gravelly sandy loam, and Wardboro very gravelly sandy loam; all with slopes of 0 to 1 percent. Also included are small areas of the Labenzo soil with a silt loam, sandy loam, or clay loam surface layer.

Permeability of this Labenzo soil is moderately rapid in the upper part and very rapid in the sand and gravel. Effective rooting depth is more than 60 inches. Available

water capacity is low. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated alfalfa hay, pasture, spring wheat, barley, and potatoes. Because of the content of gravel, potatoes are a minor crop. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation includes pasture or alfalfa hay for 4 to 6 years, and grain for 2 years, with pasture or alfalfa seeded back into the second year grain stubble. If potatoes are grown, they are generally included in an alternating year rotation with grain crops.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Sprinkler irrigation is suitable for all crops, but it is not widely used.

Permeability, low strength, and a water table that fluctuates between depths of 3 to 5 feet are the main limitations for urban use. The silt loam texture of some layers has low strength that should be considered in building and road designs. The very rapid permeability of the underlying sand and gravel is a limitation for use of sewage lagoons. Lagoons should be designed to prevent seepage that could pollute underground water sources. The content of sand and gravel below a depth of 34 inches creates a hazard of cutbanks caving in shallow excavations. The high water table and very rapid permeability of the underlying sand and gravel can cause contamination of ground water by septic tank absorption fields.

The content of gravel in the surface is a limitation for recreational uses, such as campgrounds, picnic areas, and playgrounds.

This soil is in capability subclass IIIs irrigated.

22-Labenzo silt loam. This deep, moderately well drained soil is on river terraces and flood plains. Slopes are 0 to 1 percent. This soil formed in mixed alluvium derived from the Snake River and its tributaries. It is moderately deep to sand and gravel. Elevation is about 4,800 feet. The mean annual precipitation is about 11 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is grayish brown silt loam about 13 inches thick. The underlying material is stratified, pale brown; light brownish gray; and dark gray silt loam and loamy sand about 21 inches thick over sand and gravel to a depth of more than 60 inches.

This soil is slightly effervescent throughout. Mottles are common below a depth of 17 inches. A water table is at a depth of 36 to 60 inches during summer and early in fall.

Included with this soil in mapping are small areas of Annis silty clay loam, Blackfoot silt loam, and Harston sandy loam; all with slopes of 0 to 1 percent. Also included are small areas of the Labenzo soil that have a loam, clay loam, and sandy loam surface layer, and areas with slopes of 2 to 4 percent.

Permeability of this Labenzo soil is moderate in the upper part and very rapid in the sand and gravel. Effective rooting depth is more than 60 inches. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, spring wheat, barley, alfalfa hay, and pasture. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation includes pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa seeded back into the second year grain stubble. If potatoes are grown, they are generally included in an alternating year rotation with grain crops.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Furrow irrigation is used if potatoes are grown. Sprinkler irrigation is suitable for all crops, but it is not widely used.

Low strength, a water table that fluctuates between depths of 3 to 5 feet, and the very rapid permeability of the underlying sand and gravel are the main limitations for urban use. Designs for dwellings and local roads and streets should allow for the low strength of the silt loam layers. Also local roads and streets should be designed to avoid frost damage. Vertical cuts in the sand and gravel below a depth of 30 inches cause the soil to slough easily. The high water table is a limitation for septic tanks and filter fields. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic.

This soil is in capability subclass IIs irrigated.

23-Lantonia silt loam, 0 to 4 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 5,500 to 7,000 feet. The mean annual precipitation is about 16 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 70 days.

Typically, the surface layer is dark grayish brown and brown silt loam about 17 inches thick. The upper part of the subsoil is brown silt loam about 19 inches thick. The lower part of the subsoil is pale brown, slightly effervescent silt loam about 3 inches thick. The substratum is mixed, white and very pale brown, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ard silt loam, Greys silt loam, and Tetonia silt loam; all with slopes of 0 to 4 percent. Also included are small areas with slopes more than 4 percent.

Permeability of this Lantonia soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is slight. or moderate.

This soil is mainly used for nonirrigated spring wheat at elevations above 6,500 feet and for nonirrigated winter wheat at elevations less than 6,500 feet. Barley

and alfalfa hay are also grown. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture. This soil is not currently irrigated, but most areas are suited to sprinkler irrigation. Potatoes is another crop that could be grown under irrigation.

The moderate permeability, which restricts movement of effluent through the soil, is a limitation for septic tank filter fields. Roads or streets should be designed to avoid the damage resulting from frost action. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic. Slope is also a concern in designing playgrounds.

This soil is in capability subclass IIIc nonirrigated and IIIe irrigated.

24-Lantonia silt loam, 4 to 12 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 5,500 to 7,000 feet. The mean annual precipitation is about 16 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 70 days.

Typically, the surface layer is dark grayish brown silt loam about 17 inches thick. The upper part of the subsoil is brown silt loam about 19 inches thick. The lower part of the subsoil is pale brown, calcareous silt loam about 3 inches thick. The substratum is a mixture of white and very pale brown, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ard silt loam, Greys silt loam, and Tetonia silt loam; all with slopes of 4 to 12 percent. Also included are small areas with slopes more than 12 percent.

Permeability of this Lantonia soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is mainly used for nonirrigated spring wheat at elevations above 6,500 feet and for nonirrigated winter wheat at elevations less than 6,500 feet. Some barley and alfalfa hay are also grown. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, gradient terraces, and field stripcropping.

This soil is not currently irrigated, but most areas having slopes less than 8 percent are suited to sprinkler irrigation. Potatoes is another crop that could be grown under irrigation. Application of irrigation water should be light in order to prevent erosion.

The moderate permeability, which restricts movement of effluent through the soil, is a limitation for septic tank filter fields.

Roads or streets should be designed to avoid the damage resulting from frost action and low strength. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic.

This soil is in capability subclass IIIe nonirrigated and IVe irrigated.

25-Lantonia-Tetonia silt loams, 4 to 12 percent slopes.

This complex is on dissected plateaus. These soils are deep and well drained. They formed in silty windlaid material. Elevation is 5,500 to 7,000 feet. The mean annual precipitation is about 16 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 70 days.

This complex is about 55 percent Lantonia silt loam and about 40 percent Tetonia silt loam. Included with these soils in mapping is about 5 percent Ard silt loam and Greys silt loam. Also included are small areas with slopes more than 12 percent.

Typically, the Lantonia soil has a dark grayish brown silt loam surface layer about 17 inches thick. The upper part of the subsoil is brown silt loam about 19 inches thick. The lower part of the subsoil is pale brown, slightly effervescent silt loam about 3 inches thick. The substratum is a mixture of white and pale brown, violently effervescent silt loam to a depth of more than 60 inches.

Permeability of this Lantonia soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

Typically, the Tetonia soil has a surface layer of dark grayish brown silt loam about 10 inches thick. The subsoil is brown silt loam about 12 inches thick. The substratum is light brownish gray, calcareous silt loam to a depth of more than 60 inches.

Permeability of this Tetonia soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

The soils in this complex are mainly used for nonirrigated winter wheat below elevations of 6,500 feet and for nonirrigated spring wheat at elevations above 6,500 feet. Some barley and alfalfa hay are also grown.

If properly managed, these soils produce good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilizer and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the

soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, gradient terraces, and field stripcropping.

These soils are not currently irrigated, but those with slopes less than 8 percent are suited to sprinkler irrigation. Potatoes could be grown under irrigation.

Permeability, slope, and low strength are the main limitations for urban uses. The restricted permeability of these soils reduces their effectiveness for septic tank filter fields. Steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Also, sites for dwellings need to be carefully selected or the design and method of construction need to be tailored to the site. Local streets and roads must be designed to avoid the damage resulting from frost action and low strength. Dustiness is a concern if these soils are used for recreational areas that are subject to heavy foot traffic.

This complex is in capability subclass IIIe nonirrigated and IIIe irrigated.

26-Mathon sandy loam, 0 to 6 percent slopes. This deep, well drained soil is on basalt plains. It formed in sandy windblown deposits derived from mixed sources. Elevation is about 4,900 feet. The mean annual precipitation is about 10 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is brown sandy loam about 5 inches thick. The subsoil is brown sandy loam about 8 inches thick. The upper part of the substratum is brown sandy loam about 42 inches thick. The lower part of the substratum is pale brown, violently effervescent sandy loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Modkin sandy loam with slopes of 0 to 4 percent and Grassy Butte loamy sand with slopes of 0 to 6 percent.

Permeability of this Mathon soil is moderately rapid. Effective rooting depth is more than 60 inches. Available water capacity is moderate. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate. The hazard of soil blowing is moderate.

This soil is mainly used for irrigated spring wheat, barley, alfalfa hay, and potatoes. Some areas are also used for range. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation includes alfalfa hay for 4 to 6 years and grain for 2 years, with alfalfa seeded back into the second year grain stubble. If potatoes are grown, they are generally included in an alternate year rotation with grain crops. Sprinkler irrigation is the most widely used method on this soil (fig. 10).

The native vegetation consists mainly of bluebunch wheatgrass, big sagebrush, and Thurber needlegrass. When the range condition deteriorates, the plants most likely to invade or increase are cheatgrass, rabbitbrush,



Figure 10.-Alfalfa hay seeding under sprinkler irrigation on Mathon sandy loam, 0 to 6 percent slopes. In the background on North Menan Butte are Grassy Butte and Bondbranch soils and Rock outcrops.

big sagebrush, Russian-thistle, and needlegrass. A planned grazing system, brush management, reseeding, water development, and fencing to control grazing help to maintain range condition. Species suitable for seeding are crested wheatgrass, Siberian wheatgrass, and needlegrass. The grass selected should be suitable for grazing in spring and late in fall.

Moderately rapid permeability is the main limitation for urban uses. Sewage lagoons should be designed to prevent seepage that could pollute underground water sources. Where there is dense housing, concentration of effluent from septic tank absorption fields could also cause pollution of underground water. This soil is suited to most recreational uses, although slopes more than 2 percent limit use for playgrounds.

This soil is in capability subclass IIe irrigated and IVe nonirrigated.

27-Mathon-Rock outcrop complex, 2 to 20 percent slopes. This complex is on basalt plains. Elevation is about 5,000 feet. The mean annual precipitation is about 10 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

This complex is about 40 percent Mathon loamy sand, 2 to 12 percent slopes, and 35 percent Rock outcrop with slopes of 2 to 20 percent. The remaining 25 percent

is Modkin loamy sand, 2 to 12 percent slopes, and a soil that is similar to the Mathon soil but has bedrock at a depth of 40 to 60 inches.

The Mathon soil is deep and well drained. It formed in sandy windblown material. Typically, the surface layer is brown loamy sand about 5 inches thick. The subsoil is brown sandy loam about 8 inches thick. The substratum is brown and pale brown sandy loam to a depth of more than 60 inches. The profile is violently effervescent to a depth of more than 55 inches.

Permeability of the Mathon soil is moderately rapid. Effective rooting depth is more than 60 inches. Available water capacity is moderate. Surface runoff is slow to medium, and the hazard of erosion is moderate. The hazard of soil blowing is high.

Rock outcrops occur in a random pattern. Areas of rock outcrop are 20 to 100 feet across.

The soil in this complex is used for range, wildlife habitat, and recreation.

The native vegetation is mainly big sagebrush, Indian ricegrass, bluebunch wheatgrass, western wheatgrass, needleandthread grass, and sand dropseed. When the range condition deteriorates, the plants most likely to invade or increase are cheatgrass, rabbitbrush, Russianthistle, needlegrass, and big sagebrush. Practices that can be used to maintain range condition are a planned grazing system, brush management, water development, and fencing to control grazing. Because of numerous rock outcrops, reseeding of the soil in this complex is impractical.

The main limitations for urban uses of the soil in this complex are slope and rock outcrops. The surface layer is easily eroded when left unprotected. The numerous rock outcrops limit the selection of sites for dwellings.

This complex is in capability subclass VIIe nonirrigated.

28-Mathon-Rock outcrop-Modkin complex, 0 to 12 percent slopes. This complex is on basalt plains. The soil formed in sandy windlaid material. Elevation is about 5,000 feet. The mean annual precipitation is about 10 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

This complex is about 35 percent Mathon sandy loam, about 30 percent Rock outcrop, and about 20 percent Modkin sandy loam. The remaining 15 percent is Bondbranch extremely stony sandy loam and Grassy Butte loamy sand. All of these soils have slopes of 0 to 12 percent.

The Mathon soil is deep and well drained. Typically, the surface layer is brown sandy loam about 5 inches thick. The subsoil is brown sandy loam about 8 inches thick. The upper part of the substratum is brown sandy loam about 42 inches thick. The lower part of the substratum is pale brown, violently effervescent sandy loam to a depth of more than 60 inches.

Permeability of this Mathon soil is moderately rapid. Effective rooting depth is more than 60 inches. Available water capacity is moderate. Surface runoff is slow or

medium, and the hazard of erosion is moderate. The hazard of soil blowing is moderate.

Rock outcrops occur in a random pattern and are 20 to 100 feet across.

The Modkin soil is moderately deep and well drained. Typically, the surface layer is brown sandy loam about 12 inches thick. The subsoil is brown sandy loam about 5 inches thick. The substratum is brown, strongly effervescent sandy loam about 5 inches thick over basalt.

Depth to bedrock ranges from 20 to 40 inches.

Permeability of this Modkin soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is very low. Surface runoff is medium and the hazard of erosion is moderate. The hazard of soil blowing is moderate.

The soils in this complex are used for range, wildlife habitat, and recreation.

The native vegetation consists mainly of bluebunch wheatgrass, big sagebrush, and Thurber needlegrass. When the range condition deteriorates, the plants most likely to invade or increase are cheatgrass, rabbitbrush, big sagebrush, Russian-thistle, and needlegrass. A planned grazing system, brush management, water development, and fencing to control grazing help to maintain range condition. Seeding is difficult because of the rock outcrops in the soils. Species commonly used for reseeding are the commercial wheatgrass species. The grass selected for seeding should be suitable for grazing in spring and late in fall.

Depth to rock, moderately rapid permeability, and rock outcrops are the main limitations for urban use on the soils in this complex. Rock outcrops are a limitation for the selection of sites for dwellings. This limitation as well as depth to rock, should be considered in the location of septic tanks and absorption fields. The moderately rapid permeability of these soils is a limitation for sewage lagoons. Lagoons should be designed to prevent seepage that could pollute underground water sources.

This complex is in capability subclass VIe nonirrigated.

29-Modkin-Bondbranch complex, 2 to 12 percent slopes.

This complex is on basalt plains. The soils formed in sandy windlaid material. Elevation is about 5,000 feet. The mean annual precipitation is about 10 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

This complex is about 45 percent Modkin extremely stony sandy loam with 2 to 12 percent slopes and 20 percent Bondbranch very stony sandy loam with 2 to 12 percent slopes (fig. 11). The remaining 35 percent is Rock outcrop and Mathon sandy loam with 2 to 20 percent slopes.

The Modkin soil is moderately deep and well drained. Typically, the surface layer is brown, extremely stony sandy loam about 12 inches thick. The subsoil is brown sandy loam about 5 inches thick. The substratum is brown, strongly effervescent sandy loam about 5 inches thick over basalt at a depth of 22 inches. Depth to basalt ranges from 20 to 40 inches.



Figure 11.-Roadcut in an area of Modkin-Bondbranch complex, 2 to 12 percent slopes, along State Highway 88 west of Rexburg. Differences in depth to bedrock can be readily seen. Modkin soils are in the narrow area between the pavement and the Rock outcrop.

Permeability of this Modkin soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is very low. Surface runoff is medium, and the hazard of erosion is moderate. The hazard of soil blowing is moderate.

The Bondbranch soil is shallow and well drained. Typically, the surface layer is grayish brown very stony sandy loam about 6 inches thick. The subsoil is light brownish gray, slightly effervescent sandy loam about 9 inches thick. The substratum is light brownish gray, strongly effervescent sandy loam about 3 inches thick over bedrock at a depth of 18 inches. Depth to bedrock ranges from 10 to 20 inches.

Permeability of this Bondbranch soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is very low. Surface runoff is medium, and the hazard of erosion is moderate. The hazard of soil blowing is moderate.

The soils in this complex are used for range, wildlife habitat, and recreation. The potential native vegetation consists mainly of bluebunch wheatgrass, needleandthread grass, and big sagebrush. When the range condition deteriorates, the plants most likely to invade or increase are cheatgrass, rabbitbrush, and big sagebrush. A planned grazing system, brush management, water development, and fencing to control grazing help to maintain range condition. Seeding of the soils in this complex

is difficult because of the content of surface stones and the numerous rock outcrops.

Surface stones, the moderate and shallow depth to bedrock, and the moderately rapid permeability are limitations for urban use. Rock outcrops, surface stones, and areas with slopes more than 8 percent limit the selection of sites for dwellings. These limitations should also be considered in the location of septic tanks and absorption fields. Stones in the surface layer should be removed before the establishment of lawns. Sewage lagoons should be designed to prevent seepage that could pollute underground water sources. Surface stones and slope limit the location of recreational facilities, such as campgrounds, picnic areas, and playgrounds.

This complex is in capability subclass VIIs nonirrigated.

30-Panmod silt loam, 4 to 12 percent slopes. This moderately deep over hardpan, well drained soil is on dissected basalt plains. It formed in silty windlaid material. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

Typically, the surface layer is brown, slightly effervescent silt loam about 11 inches thick. The subsoil is light brownish gray, violently effervescent silt loam about 14 inches thick. The upper part of the substratum is an 11 inch hardpan. Below a depth of 36 inches is pinkish white, violently effervescent silt loam to a depth of 50 inches over the lower part of the hardpan. In some places the lower part of the hardpan overlies bedrock.

Included with this soil in mapping are small areas of Pocatello, Rexburg, and Ririe silt loams and Swanner very stony loam, all with slopes of 0 to 20 percent. Also included are small areas of Panmod soils with slopes less than 4 percent.

Permeability of this Panmod soil is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used for nonirrigated winter wheat and barley and for irrigated spring wheat, barley, and potatoes. A few areas are used for alfalfa hay. If properly managed, this soil produces good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilizer and weed control programs, and practices to control erosion. An adequate conservation program is achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

Sprinkler irrigation is the most suitable method for this soil. Irrigation systems should be designed so that excessive water is not applied, which can cause erosion during irrigation. Irrigation suitability on slopes more than 8 percent is questionable. Grain and potatoes are usually included in an alternate year rotation.

Low strength, the depth to hardpan, and the hazard of erosion are the main limitations for urban and recreation uses on this soil. The location of septic tanks and the movement of leachates from filter fields are restricted by the underlying hardpan. Dwelling and road designs should be modified to offset the low strength of the soil.

This soil is in capability subclass IVe irrigated and nonirrigated.

31-Pocatello Variant silt loam, 2 to 4 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

Typically, the surface layer and the upper part of the underlying material are light brownish gray, strongly effervescent silt loam about 12 inches thick. The lower part of the underlying material is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are areas of Panmod, Rexburg, and Ririe silt loams; all with slopes of 2 to 4 percent. Also included are small areas with slopes less than 2 percent.

Permeability of this Pocatello Variant soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for nonirrigated winter wheat and barley and for irrigated spring wheat, barley, alfalfa hay, and potatoes. If properly managed, this soil produces good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program is achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil.

Under irrigation, potatoes and grain are grown in an alternate year rotation. Some alfalfa hay is also grown under irrigation. Sprinkler irrigation is the most suitable method for this soil. Application rates should be kept light to prevent erosion.

Permeability, frost action, and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. Local streets and roads should be designed to avoid the damage resulting from frost action and low strength. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic.

This soil is in capability subclass IIIe irrigated and IIIc nonirrigated.

32-Pocatello Variant silt loam, 4 to 8 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is

about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

Typically, the surface layer and the upper part of the underlying material are light brownish gray, strongly effervescent silt loam about 12 inches thick. The lower part of the underlying material is light gray, violently effervescent silt loam to a depth more than 60 inches.

Included with this soil in mapping are small areas of Ririe, Panmod, and Rexburg silt loams; all with slopes of 4 to 8 percent. Also included are small areas with 5 to 15 percent stones in the surface layer.

Permeability of this Pocatello Variant soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used for nonirrigated winter wheat and barley and for irrigated spring wheat, barley, alfalfa hay, and potatoes. If properly managed, this soil produces good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

Under irrigation, potatoes and grain are grown in an alternate year rotation. Some alfalfa hay is also grown.

The most suitable method is sprinkler irrigation. Application rates should be kept light to prevent erosion.

Permeability, slope, frost action, and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. Local streets and roads should be designed to avoid the damage resulting from frost action and low strength. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic. Slope is also a limitation for recreational facilities.

This soil is in capability subclass IIIe irrigated and nonirrigated.

33-Pocatello Variant silt loam, 8 to 12 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

Typically, the surface layer and the upper part of the underlying material are light brownish gray, strongly effervescent silt loam about 12 inches thick. The lower part of the underlying material is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Panmod, Rexburg, and Ririe silt loams; all with slopes of

8 to 12 percent. Also, included are small areas with 5 to 15 percent stones in the surface layer.

Permeability of this Pocatello Variant soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used for nonirrigated wheat and barley and for irrigated wheat, barley, alfalfa hay, and potatoes. If properly managed, this soil produces good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

Under irrigation, application rates should be kept light to prevent erosion. Potatoes and grain are grown in an alternate year rotation. Some alfalfa hay is also grown. The most suitable method of irrigation is sprinkler. The suitability of irrigation on slopes more than 8 percent is questionable.

Permeability, slope, frost action, and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. Steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Because of slope, sites for dwellings should be carefully selected or the design and method of construction should be tailored to the site. Local streets and roads should be designed to avoid the damage resulting from frost action and low strength.

Dustiness is a concern if these soils are used for recreation areas that are subject to heavy foot traffic. Slope is also a limitation for locating campsites, picnic areas, and playgrounds.

This soil is in capability subclass IVe irrigated and IIIe nonirrigated.

34-Pocatello Variant silt loam, 12 to 20 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is 12 to 16 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

Typically, the surface layer and the upper part of the underlying material are light brownish gray, moderately effervescent silt loam about 12 inches thick. The lower part of the underlying material is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Rexburg and Ririe silt loams and Swanner stony loam, all with slopes of 4 to 20 percent. Also included are small areas with slopes more than 20 percent and small areas with a stony surface layer.

Permeability of this Pocatello Variant soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is rapid, and the hazard of erosion is high.

This soil is used for wildlife habitat, recreation, and nonirrigated cropland. Many areas of this soil remain idle. Isolated, long and narrow areas separate less sloping soils.

This soil is marginal for cultivation. Crops grown are mainly nonirrigated winter wheat with some barley and alfalfa hay used in an alternating grain-fallow rotation. Cultivation of these soils should be accompanied by a good conservation program.

An effective conservation program is one that includes an adequate crop rotation, suitable fertilizer and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field strip cropping. This soil is not suitable for irrigation, because slopes are 12 to 20 percent.

Slope is the main limitation for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. Steep slopes create problems in the location of sites for septic tank filter fields. Because of the steep slopes, sites for dwellings must be carefully selected or the design and method of construction needs to be tailored to the site. Local streets and roads should be designed to avoid the damage resulting from frost action and should conform to slopes. Slope is also the main limitation in the location of sites for recreational facilities.

This soil is in capability subclass IVe nonirrigated.

35-Pocatello Variant-Rock outcrop complex, 20 to 60 percent slopes. This complex is on dissected plateaus. Elevation is 4,900 to 5,700 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

This complex is about 45 percent Pocatello Variant silt loam, 20 to 30 percent slopes, and 30 percent Rock outcrop with slopes of 20 to 60 percent. The remaining 25 percent is Rexburg and Ririe silt loams and Rammel very stony loam.

The Pocatello Variant soil is deep and well drained. It formed in silty windlaid material along the edges of dissected plateaus and on steep canyon walls. Typically, the surface layer and the upper part of the underlying material are light brownish gray, strongly effervescent silt loam about 12 inches thick. The lower part of the underlying material is light gray, violently effervescent silt loam to a depth of more than 60 inches. Some areas near rock outcrops have scattered surface stones.

This soil has moderate permeability. Effective rooting depth is more than 60 inches. Available water capacity is

high. Runoff is rapid, and the hazard of erosion is very high.

Rock outcrops are in a random pattern and are 20 to 200 feet across.

The soil in this complex is used for range, wildlife habitat, and recreation. The potential native vegetation consists mainly of bluebunch wheatgrass, slender wheatgrass, prairie junegrass, Nevada bluegrass, arrowleaf balsamroot, and antelope bitterbrush. When the range condition deteriorates, the plants most likely to invade or increase are cheatgrass, rabbitbrush, horsebrush, and annual forbs. A planned grazing system, brush management, water development, and fencing to control grazing help to maintain range condition. Seeding is impractical because of the slopes and the large number of rock outcrops.

The steep slopes and numerous rock outcrops are severe limitations for urban and recreational uses.

This soil is in capability subclass VIIs nonirrigated.

36-Rammel-Rock outcrop complex, 8 to 20 percent slopes. This complex is on rhyolitic canyon sides of Moody Creek, Canyon Creek, and associated drainageways. Elevation is 5,200 to 7,000 feet. The mean annual precipitation is about 16 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 70 days.

This complex is about 50 percent Rammel very stony loam with 8 to 20 percent slopes and 25 percent Rock outcrop. The remaining 25 percent is Swanner extremely stony loam, Greys silt loam, Ard flaggy silt loam, and Ririe silt loam. Also included are small areas of a fine textured, poorly drained soil with slopes of 0 to 4 percent. This soil is on the bottom of canyons along drainageways.

The Rammel soil is moderately deep and well drained. It formed in silty windlaid material over rhyolite bedrock. Typically, the surface layer is dark grayish brown very stony loam about 8 inches thick. The subsoil is brown stony loam about 18 inches thick. The substratum is pale brown, slightly effervescent stony loam about 5 inches thick over bedrock. Depth to bedrock is 20 to 40 inches.

Permeability of the Rammel soil is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is very low or low. Surface runoff is medium, and the hazard of erosion is moderate.

Rock outcrops are in a random pattern and are 20 to 100 feet across.

The soil in this complex is used for range, wildlife habitat, and recreation. The potential native vegetation consists mainly of bluebunch wheatgrass, Idaho fescue, and mountain big sagebrush. When the range condition deteriorates, the plants most likely to invade or increase are big sagebrush, rabbitbrush, cheatgrass, Russian-thistle, and needlegrass. A planned grazing system, water development, and fencing to control grazing help to maintain range condition. Seeding is impractical because of the rock outcrops.

Slope, depth to bedrock, the content of surface and subsurface stones, and rock outcrops are the main limitations for urban use. Slope and rock outcrops are limitations for the selection of sites for dwellings. These limitations, as well as the content of stones, greatly limit the choice of locations for septic tanks and absorption fields.

Slope and surface stones are the main limitations for recreational facilities, such as playgrounds, picnic areas, and camp areas. Paths and trails can be constructed on this soil, but stones and rock outcrops interfere with trail maintenance.

This complex is in capability subclass VIIc nonirrigated.

37-Rammel-Rock outcrop complex, 20 to 60 percent slopes. This complex is on canyon sides along the Teton River, Moody Creek, Canyon Creek, and associated drainageways. Elevation is 5,200 to 7,000 feet. The mean annual precipitation is about 16 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 70 days.

This complex is about 40 percent Rammel very stony loam with 20 to 60 percent slopes and 35 percent Rock outcrop. The remaining 25 percent is Swanner extremely stony loam, Greys silt loam, and Ard flaggy silt loam, all with slopes of 20 to 60 percent. Included are small areas of a fine textured, poorly drained soil with slopes of 0 to 4 percent. This soil is along streams. Also included are small areas that have 10 to 25 percent surface stones and areas that are deep to bedrock.

The Rammel soil is moderately deep and well drained. It formed in silty windlaid material over rhyolite. Typically, the surface layer is dark grayish brown very stony loam about 8 inches thick. The subsoil is brown stony loam about 18 inches thick. The substratum is pale brown, slightly effervescent stony loam about 5 inches thick over bedrock. Depth to bedrock ranges from 20 to 40 inches.

Permeability of this Rammel soil is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is very low or low. Surface runoff is very rapid, and the hazard of erosion is high.

Rock outcrop is in a random pattern throughout the complex. Areas of Rock outcrop are 2 to 100 feet across.

The soil in this complex is used for range and wildlife habitat. The potential native vegetation consists of bluebunch wheatgrass, antelope bitterbrush, and mountain big sagebrush. When the range condition deteriorates, the plants most likely to invade or increase are cheatgrass, horsebrush, annual forbs, and rabbitbrush. A planned grazing system, water development, and fencing to control grazing help to maintain range condition. Seeding is impractical because of the steep slopes, rock outcrops, moderate depth to rock, and content of stones.

The steep slopes and rock outcrops are limitations for structures and recreational uses.

This complex is in capability subclass VIIc nonirrigated.

38-Rexburg silt loam, 0 to 2 percent slopes. This well drained, deep soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 4,800 to 5,000 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

Typically, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is brown and light brownish gray silt loam about 9 inches thick. The substratum is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ririe, Panmod, and Pocatello Variant silt loams, all with slopes of 0 to 4 percent. Also included are small areas of a soil that is similar to the Rexburg soil, but these areas have a dark surface layer and are not effervescent.

Permeability of this Rexburg soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for nonirrigated winter wheat and barley and irrigated spring wheat, barley, potatoes, and alfalfa hay. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture.

Under irrigation, potatoes and grain are grown in an alternate year rotation. When alfalfa hay is used, it is seeded and followed by a grain or potato crop after 4 to 6 years. The most suitable irrigation method is sprinkler. A limited area is irrigated by the border and furrow methods.

Permeability and low strength are the main limitations for urban uses. Moderate permeability, which restricts movement of effluent through the soil, is a limitation for septic tank filter fields. Roads and streets should be designed to avoid the damage resulting from frost action or the inability of this silt loam soil to support loads. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic.

This soil is in capability subclass IIIc irrigated and nonirrigated.

39-Rexburg silt loam, 2 to 4 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

Typically, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is brown and light brownish gray silt loam about 9 inches thick. The

substratum is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ririe, Panmod, and Pocatello Variant silt loams; all with slopes of 2 to 4 percent. Also included are small areas with slopes more than 4 percent and small areas of a soil that is similar to the Rexburg soil, but these areas are not effervescent and have a thicker and darker colored surface layer.

Permeability of this Rexburg soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for nonirrigated winter wheat and barley and for irrigated spring wheat, barley, and potatoes. A few areas are used for irrigated alfalfa hay. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture.

Under irrigation, potatoes and grain are grown in an alternate year rotation. The most suitable irrigation method is sprinkler. Application of water should be kept light to prevent erosion.

Permeability and low strength are the main limitations for urban uses. Moderate permeability, which restricts the movement of effluent through the soil, is a limitation for septic tank filter fields. Low strength should be considered in the design and construction of roads and streets to minimize breakup. Roads and streets should also be designed to avoid the damage resulting from frost action. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic.

This soil is in capability subclass IIIe irrigated and IIIc nonirrigated.

40-Rexburg silt loam, 4 to 8 percent slopes. This well drained, deep soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

Typically, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is brown and light brownish gray silt loam about 9 inches thick. The substratum is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ririe, Panmod, and Pocatello Variant silt loams, and Swanner very stony loam; all with slopes of 4 to 8 percent. Also included are small areas of a soil that is similar to the Rexburg soil, but these areas have a thicker and darker colored surface layer and are not effervescent.

Permeability of this Rexburg soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used for nonirrigated winter wheat and barley and for irrigated spring wheat, barley, and potatoes. A few areas are used for irrigated alfalfa hay. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture.

Under irrigation, potatoes and grain are grown in an alternate year rotation. The most suitable irrigation method is sprinkler. Application rates should be kept light to prevent erosion.

Permeability, low strength, and slope are the main limitations for urban uses. Moderate permeability, which restricts movement of effluent through the soil, is a limitation for septic tank filter fields. Low strength should be considered in construction and design of roads and streets to prevent breakup. Roads and streets should also be designed to avoid the damage resulting from frost action. Slope should be considered in the location and design of small commercial buildings. This soil has potential for camp sites, picnic areas, and paths and trails. Dustiness is a concern if these areas are subject to heavy foot traffic. Slopes of more than 6 percent severely limit the use of this soil for playgrounds.

This soil is in capability subclass IIIe irrigated and nonirrigated.

41-Rexburg silt loam, 8 to 12 percent slopes. This well drained, deep soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

Typically, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is brown and light brownish gray silt loam about 9 inches thick. The substratum is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ririe, Panmod, and Pocatello Variant silt loams, and Swanner very stony loam; all with slopes of 8 to 12 percent.

Permeability of this Rexburg soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is mainly used for nonirrigated winter wheat and barley. Some areas are used for irrigated spring wheat, barley, and potatoes. If properly managed, this

soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. These practices also help to maintain soil moisture. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

Under irrigation, potatoes and grain are grown in an alternate year rotation. Row crops on these 8 to 12 percent slopes greatly increase the possibility of erosion. The most suitable irrigation method is sprinkler. Application rates should be kept light to avoid erosion on these steeper slopes.

Permeability, slope, and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. Steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Where the soil is steep, sites for dwellings should be carefully selected or the design and method of construction should be tailored to the site. Local streets and roads should be designed to avoid the damage resulting from frost action and low strength. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic. Slope is also a limitation for locating sites for recreational facilities, such as campgrounds, picnic areas, and playgrounds.

This soil is in capability subclass IVe irrigated and IIle nonirrigated.

42-Rexburg silt loam, 12 to 20 percent slopes.

This well drained, deep soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

Typically, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is brown and light brownish gray silt loam about 9 inches thick. The substratum is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ririe, Panmod, and Pocatello Variant silt loams and Swanner very stony loam; all with slopes of 12 to 20 percent. Also included are areas of Rexburg silt loam with slopes more than 20 percent.

Permeability of this Rexburg soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is rapid, and the hazard of erosion is high.

This soil is mostly used for nonirrigated winter wheat and barley. If properly managed, this soil produces good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation,

suitable fertilizer and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

Because of the steeper slopes, suitability for irrigation is limited to permanent pasture. Application of water should be kept light and should be closely monitored to prevent erosion.

Slope is the main limitation for urban and recreational uses. It severely limits the location of dwellings. Steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Slope should be considered when locating sites for roads and streets. Roads and streets should also be designed to avoid the damage resulting from frost action. Slopes severely limit the choice of locations for camp sites and picnic areas. Dustiness is a concern where paths and trails are subject to heavy use.

This soil is in capability subclass VIe irrigated and IIIe nonirrigated.

43-Ririe silt loam, 0 to 4 percent slopes. This well drained, deep soil is on west and south-facing plateaus. It formed in silty windlaid material. Elevation is 5,000 to 7,000 feet. The mean annual precipitation is about 15 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 85 days.

Typically, the surface layer is grayish brown silt loam about 9 inches thick. The underlying material is pale brown and light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Rexburg, Pocatello Variant, and Tetonia silt loams; all with slopes of 0 to 4 percent. Also included are small areas with slopes more than 4 percent.

Permeability of this Ririe soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for nonirrigated wheat and barley and for irrigated wheat, barley, and potatoes. A few areas are used for irrigated alfalfa hay. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture.

Under irrigation, potatoes and grain are grown in an alternate year rotation. The most suitable irrigation method is sprinkler. Application rates should be kept light to prevent erosion.

Permeability and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. The design of local roads and streets should compensate for the inability of the soil to support a load. Local streets and roads should also be designed to avoid the damage resulting from frost action. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic.

This soil is in capability subclass IIIe irrigated and IIIc nonirrigated.

44-Ririe silt loam, 4 to 8 percent slopes. This well drained, deep soil is on west- and south-facing dissected plateaus. It formed in silty windlaid material. Elevation is 5,000 to 7,000 feet. The mean annual precipitation is about 15 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 85 days.

Typically, the surface layer is grayish brown silt loam about 9 inches thick. The underlying material is pale brown and light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Pocatello Variant, Rexburg, and Tetonia silt loams; all with slopes of 4 to 8 percent. Also included are small areas with slopes of more than 8 percent.

Permeability of this Ririe soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used for nonirrigated wheat and barley and for irrigated wheat, barley, and potatoes. A few areas are used for irrigated alfalfa hay. If properly managed, this soil produces good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

Under irrigation, potatoes and grain are grown in an alternate year rotation. The most suitable irrigation method is sprinkler. When row crops are grown, the hazard of erosion is increased and application rates of irrigation water should be kept light.

Permeability, slope, and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. Slope is a limitation for small commercial buildings. Local streets and roads should be designed to avoid the damage resulting from frost action or low strength. Dustiness is a concern if this soil is used for

recreational areas that are subject to heavy foot traffic. Slopes more than 6 percent are a severe limitation for playgrounds.

This soil is in capability subclass IIIe irrigated and nonirrigated.

45-Ririe silt loam, 8 to 12 percent slopes. This well drained, deep soil is on west- and south-facing dissected plateaus. It formed in silty windlaid material. Elevation is 5,000 to 7,000 feet. The mean annual precipitation is about 15 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 85 days.

Typically, the surface layer is grayish brown silt loam about 9 inches thick. The underlying material is pale brown and light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Pocatello Variant, Rexburg, and Tetonia silt loams; all with slopes of 8 to 12 percent. Also included are small areas with slopes more than 12 percent and less than 8 percent.

Permeability of this Ririe soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used for nonirrigated wheat and barley and for irrigated wheat, barley, and potatoes. A few areas are used for irrigated alfalfa hay. If properly managed, this soil produces good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

Under irrigation, potatoes and grain are grown in alternate year rotation. The most suitable irrigation method is sprinkler. On the steeper slopes, application of irrigation water should be kept light to prevent erosion.

This soil is limited for urbanization mainly by permeability, slope, and soil strength. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. Steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Because of slope, sites for dwellings should be carefully selected or the design and method of construction should be tailored to the site. Local streets and roads should be designed to avoid the damage resulting from frost action and low strength. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic. Slope limits the choice of locations for recreational facilities.

This soil is in capability subclass IVe irrigated and IIIe nonirrigated.

46-Ririe silt loam, 12 to 20 percent slopes. This well drained, deep soil is on west- and south-facing dissected plateaus. It formed in silty windlaid material. Elevation is 5,000 to 7,000 feet. The mean annual precipitation is about 15 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 85 days.

Typically, the surface layer is grayish brown silt loam about 9 inches thick. The underlying material is pale brown and light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ard silt loam with 4 to 12 percent slopes and Rexburg and Tetonia silt loams with 12 to 20 percent slopes. Also included are small areas with slopes less than 12 percent.

Permeability of this Ririe soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is rapid, and the hazard of erosion is high.

This soil is used for nonirrigated wheat and barley. If properly managed, this soil produces good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

Permeability, slope, and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. The steeper slopes are a severe limitation for the design of septic tank filter fields. Because of slope, sites for dwellings need to be carefully selected or the design and method of construction need to be tailored to the site. Slope and low strength should be considered when locating sites for streets and roads. Slope severely limits the choice of locations for recreational facilities, such as campgrounds and picnic areas. Dustiness is a concern where recreational areas are subject to heavy use.

This soil is in capability subclass IIIe nonirrigated.

47-Ririe silt loam, 20 to 30 percent slopes. This deep, well drained soil is on west- and south-facing dissected plateaus. It formed in silty windlaid material. Elevation is 5,000 to 7,000 feet. The mean annual precipitation is about 15 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 85 days.

Typically, the surface layer is grayish brown silt loam about 9 inches thick. The underlying material is pale brown and light gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ard silt loam with slopes of 4 to 12 percent, Rexburg silt

loam with slopes of 12 to 20 percent, and Tetonia silt loam with slopes of 20 to 30 percent. Also included are small areas with slopes more than 30 percent and areas with slopes less than 20 percent.

Permeability of this Ririe soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is rapid, and the hazard of erosion is high.

This soil is mostly suited to wildlife habitat and recreation. Some areas are used for nonirrigated wheat and barley. The moderately steep slopes make cultivation questionable.

Many idle areas of this soil are used for native vegetation but are not used for rangeland. These areas are long and narrow and occupy a moderately steep break between two less sloping cropland areas.

The potential native vegetation consists mainly of bluebunch wheatgrass, Idaho fescue, and mountain big sagebrush.

Steep slopes are the main limitation for urban uses. This limitation also severely limits the choice of locations for recreational facilities.

This soil is in capability subclass IVe nonirrigated.

48-Ririe-Rexburg silt loams, 4 to 12 percent slopes. This complex is on foothills. The soils formed in silty windlaid material. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

The Ririe soil is on the ridges and the southern and western exposures. It makes up about 60 percent of the unit. The Rexburg soil is on the northern and eastern exposures and in concave areas. It makes up about 30 percent of the unit. The remaining 10 percent is Pocatello Variant silt loam and scattered rock outcrops.

Typically, the Ririe soil has a surface layer of grayish brown silt loam about 9 inches thick. The underlying material is pale brown and light gray, violently effervescent silt loam to a depth of more than 60 inches.

Permeability of this Ririe soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

Typically, the Rexburg soil has a surface layer of dark grayish brown silt loam about 12 inches thick. The subsoil is brown and light brownish gray silt loam about 12 inches thick. The subsoil is brown and light brownish gray silt loam about 9 inches thick. The substratum is light gray, violently effervescent silt loam to a depth of more than 60 inches.

Permeability of this Rexburg soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

These soils are used for nonirrigated wheat or barley and for irrigated spring wheat, barley, and potatoes. A few areas are used for irrigated alfalfa hay (fig. 12). If

properly managed, these soils produce good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

Under irrigation, potatoes and grain are grown in an alternate year rotation. The most suitable irrigation method is sprinkler. Application of irrigation water should be light to prevent erosion.

Permeability, slope, and low strength are the main limitations for urban uses. The restricted permeability of these soils reduces their effectiveness for septic tank filter fields. Steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. If slopes are more than 8 percent, sites for dwellings should be carefully selected or the design and method of construction should be tailored to the site. Local streets and roads should be designed to avoid the damage resulting from frost action or low strength. Dustiness is a concern if these soils are used

for recreational areas that are subject to heavy foot traffic. Slope is also a limitation for recreational uses.

These soils are in capability subclass IVE irrigated and IIIe nonirrigated.

49-Riverwash. This unit consists of water-washed, mixed sand and gravel. Most of the unit occurs in the form of sand or gravel bars along the Snake River. It is generally flooded by water late in spring, and it is normally bare of vegetation.

Some areas of this unit are suitable for wildlife habitat and recreational use.

This unit is in capability class VIII nonirrigated.

50-Rock outcrop-Bondbranch complex, 2 to 40

percent slopes. This complex is on basalt plains and old volcanic cones. Elevation is about 5,000 feet. The mean annual precipitation is about 10 inches, the mean annual air temperature is about 42 degrees F., and the frost-free period is about 105 days.

This complex is about 65 percent Rock outcrop with slopes of 2 to 40 percent and 20 percent Bondbranch extremely stony sandy loam with slopes of 2 to 12 percent. The remaining 15 percent is Mathon and Modkin sandy loams and Grassy Butte loamy sand, all with slopes of 2 to 20 percent (fig. 13).

Rock outcrops are in a random pattern throughout the complex, generally in elevated positions above the soil surface.

The Bondbranch soil is shallow and well drained. It formed in silty windlaid material. The surface layer is grayish brown extremely stony sandy loam about 6 inches thick. The subsoil is light brownish gray sandy loam about 9 inches thick. The substratum is light brownish gray sandy loam about 3 inches thick over bedrock. Depth to bedrock ranges from 10 to 20 inches.

Permeability of this Bondbranch soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is medium, and the hazard of erosion is slight or moderate. The hazard of soil blowing is moderate.

The soil in this complex is used for range, wildlife habitat, and recreation. The potential native vegetation consists mainly of bluebunch wheatgrass, big sagebrush, and arrowleaf balsamroot. When the range condition deteriorates, the plants most likely to invade or increase are sagebrush, rabbitbrush, and cheatgrass. A planned grazing system, brush management, water development, and fencing to control grazing help to maintain the range condition. Seeding on the soil in this complex is impractical because of the numerous rock outcrops.

Depth to rock, slope, and the numerous rock outcrops and surface stones are severe limitations for structural and recreational development.

This complex is in capability subclass VIIs nonirrigated.

51-Rock outcrop-Pocatello Variant complex, 30 to 60 percent slopes. This complex is on dissected pla-

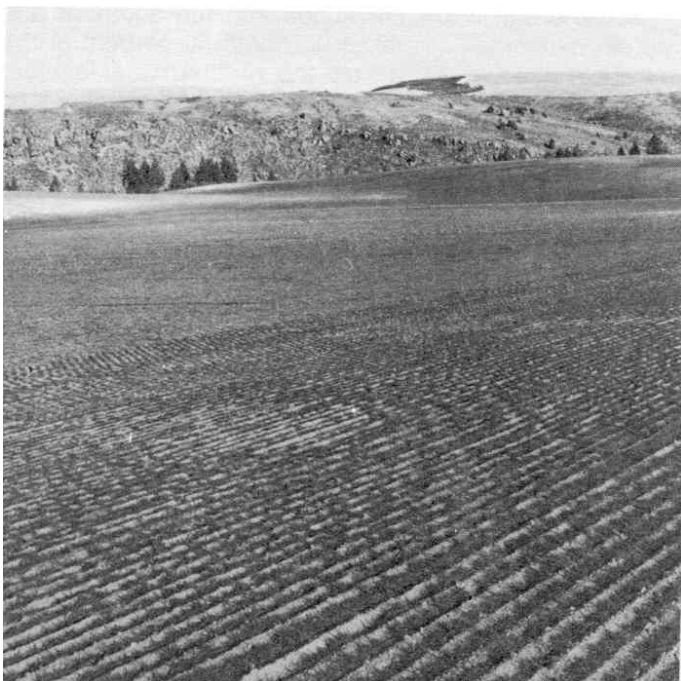


Figure 12.-Seeding of dryland grain on Ririe-Rexburg silt loams, 4 to 12 percent slopes. Swanner-Rock outcrop complex, 30 to 60 percent slopes, is on the steep area in the background.



Figure 13.-Northern view from atop the south cone of Menan Buttes. In the foreground are Bondbranch soils with numerous Rock outcrops and surface stones. Haplaquolls are along Henry's Fork of the Snake River in the center.

teaus. Elevation is 4,800 to 5,700 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 90 days.

This complex is about 45 percent Rock outcrop and 30 percent Pocatello Variant silt loam with slopes of 30 to 60 percent. The remaining 25 percent is Panmod silt loam and Swanner extremely stony loam with slopes of 30 to 60 percent. A small area of this unit joining Jefferson County contains up to 25 percent Rexburg silt loam.

Rock outcrops are in a random pattern throughout the complex.

The Pocatello Variant soil is deep and well drained. It formed in silty windlaid material. Typically, the surface layer and the upper part of the underlying material is light brownish gray, strongly effervescent silt loam about 12 inches thick. The underlying material is light gray, violently effervescent silt loam to a depth of more than 60 inches. Some areas have occasional stones in the surface layer.

Permeability of this Pocatello variant soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is very rapid, and the hazard of erosion is very high.

The soil in this complex is used for range and wildlife habitat. The potential native vegetation consists mainly of bluebunch wheatgrass, slender wheatgrass, prairie Junegrass, Nevada bluegrass, arrowleaf balsamroot, and antelope bitterbrush. When the range condition deteriorates, the plants most likely to invade or increase include annual grasses and forbs and horsebrush. A planned grazing system, brush management, water development, and fencing to control grazing help to maintain the range condition. Seeding is impractical because of the steep slopes and numerous rock outcrops.

Steep slopes and numerous rock outcrops are severe limitations for urban and recreational development.

This complex is in capability subclass VIIIs nonirrigated.

52-Swanner-Rock outcrop complex, 2 to 30 percent slopes. This complex is on canyon sides, toe slopes, and scarps between plateaus and bottom lands. Elevation is 4,800 to 6,000 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 80 days.

This complex is about 50 percent Swanner extremely stony loam with slopes of 2 to 30 percent and 25 percent Rock outcrop. The remaining 25 percent is Rammel very stony loam, Greys silt loam, and Ard flaggy silt loam, all with slopes of 12 to 60 percent.

The Swanner soil is shallow and well drained. It formed in silty windlaid material over rhyolite. Typically, the surface layer is grayish brown extremely stony loam about 6 inches thick. The upper part of the underlying material is brown very stony loam about 4 inches thick. The lower part is light yellowish brown, violently effervescent extremely stony loam 6 inches thick over bedrock. Depth to the bedrock ranges from 10 to 20 inches.

Permeability of this Swanner soil is moderate. Effective rooting depth is 10 to 20 inches. Available water capacity is very low. Runoff is medium, and the hazard of erosion is moderate.

Rock outcrops are in a random pattern throughout the complex.

The soil in this complex is used for range, wildlife habitat, and recreation. The potential native vegetation consists mainly of bluebunch wheatgrass, Sandberg bluegrass, and low sagebrush. When the range condition deteriorates, the plants most likely to invade or increase are Russian-thistle, annual forbs, and cheatgrass. A planned grazing system, brush management, water development, and fencing to control grazing help to maintain the range condition. Seeding is impractical because of the steep slopes and large number of rock outcrops.

Rock outcrops, shallow soil depth, and steep slopes are limitations for urban uses. These limitations are also severe limitations for recreational development.

This complex is in capability subclass VIIIs nonirrigated.

53-Swanner-Rock outcrop complex, 30 to 60 percent slopes. This complex is on canyon sides and

scarps between plateaus and bottom lands along the Teton River, Canyon Creek, Moody Creek, and associated drainageways. Elevation is 4,800 to 5,500 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 40 degrees F., and the frost-free period is about 80 days.

The complex is about 40 percent Swanner extremely stony loam with 30 to 60 percent slope and 35 percent Rock outcrops (fig. 14). The remaining 25 percent is Rammel very stony loam and Ard flaggy silt loam also with slopes of 30 to 60 percent.

The Swanner soil is shallow and well drained. It formed in silty windlaid material over rhyolite or closely associated bedrock. Typically, the surface layer is grayish brown extremely stony loam about 6 inches thick. The upper part of the underlying material is brown extremely stony loam about 4 inches thick. The lower part is light yellowish brown, violently effervescent extremely stony loam about 6 inches thick over bedrock. Depth to bedrock ranges from 10 to 20 inches.

Permeability of this Swanner soil is moderate. Effective rooting depth is 10 to 20 inches. Available water capacity is very low. Runoff is rapid, and the hazard of erosion is high.

Rock outcrops are in a random pattern throughout the complex.

The soil in this complex is used for range and wildlife habitat. The potential native vegetation consists mainly of bluebunch wheatgrass and low sagebrush. When the range condition deteriorates, the plants most likely to invade or increase are horsebrush, annual grasses, and annual forbs. A planned grazing system, water development, brush management, and fencing to control grazing help to maintain the range condition. Seeding is impractical because of the steep slopes and numerous surface stones and rock outcrops.

Steep slopes, the shallow depth, and numerous rock outcrops and surface stones are limitations for urban and recreational development.

This complex is in capability subclass VIIIs nonirrigated.

54-Tetonia silt loam, 0 to 4 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation ranges from 5,700 to 7,000 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 75 days.

Typically, the surface layer is grayish brown silt loam about 10 inches thick. The subsoil is brown silt loam about 12 inches thick. The substratum is light brownish gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Greys, Lantonia, and Ririe silt loams; all with slopes of 0 to 4 percent. Also included are small areas with slopes more than 4 percent.

Permeability of this Tetonia soil is moderate. Effective rooting depth is more than 60 inches. Available water



Figure 14.-Swanner-Rock outcrop complex, 30 to 60 percent slopes, on steep, south-facing slopes. Douglas-fir and lodgepole pine, in the center, are on north-facing slopes on the Judkins soil. Ard soils are along the road in the foreground.

capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is mainly used for nonirrigated winter wheat. Some nonirrigated spring wheat is grown at an elevation of more than 6,500 feet. Some nonirrigated barley and alfalfa hay are also grown on this soil; they could also be grown under irrigation.

If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture.

Only a few areas of this soil are currently irrigated, but most areas are suited to sprinkler irrigation. Potatoes is another crop that is grown under irrigation.

Permeability and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. Local streets and roads should be designed to avoid the

damage resulting from frost action. They should also be constructed to compensate for low strength, thereby reducing breakup. Dustiness is a concern if these soils are used for recreational areas that are subject to heavy foot traffic. Slope is also a limitation, and in some areas, limits the use of this soil for playgrounds.

This soil is in capability subclass IIIe irrigated and IIIc nonirrigated.

55-Tetonia silt loam, 4 to 8 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 5,700 to 7,000 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 39 degrees F., and the average frost-free period is about 75 days.

Typically, the surface layer is grayish brown silt loam about 10 inches thick. The subsoil is brown silt loam about 12 inches thick. The substratum is light brownish gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ard, Greys, Lantonia, and Ririe silt loams, all with slopes

of 4 to 8 percent. Also included are areas with slopes of more than 8 percent.

Permeability of this Tetonia soil is moderate. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is more than 60 inches.

This soil is mainly used for nonirrigated winter wheat. Some nonirrigated spring wheat is grown at an elevation of more than 6,500 feet. A few areas are used for nonirrigated barley and alfalfa hay; these crops could also be grown under irrigation.

If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture.

Only a few areas of this soil are currently irrigated, but most areas are suited to sprinkler irrigation. Potatoes is an additional crop that is grown under irrigation.

Moderate permeability, which restricts movement of effluent through the soil, is a limitation for septic tank filter fields.

Roads or streets should be designed to avoid the damage resulting from frost action and low strength. Dustiness is a concern if this soil is used for recreational areas that are subject to heavy foot traffic. Use for playgrounds is limited by slope.

This soil is in capability subclasses II_{le} irrigated and nonirrigated.

56-Tetonia silt loam, 8 to 12 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 5,700 to 7,000 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 75 days.

Typically, the surface layer is grayish brown silt loam about 10 inches thick. The subsoil is brown silt loam about 12 inches thick. The substratum is light brownish gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ard, Greys, and Lantonia silt loams; all with slopes of 8 to 12 percent.

Permeability of this Tetonia soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is mainly used for nonirrigated winter wheat. Nonirrigated spring wheat is grown at elevations above 6,500 feet. Some barley and alfalfa hay are also grown. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertiliza-

tion and weed control programs. An adequate conservation program is provided by a continuous cropping system if minimum tillage is used and crop residue is returned to the soil. These practices, together with an alternating grain-fallow rotation, also help to maintain soil moisture.

Only a few areas of this soil are currently irrigated. Irrigation on slopes more than 8 percent is questionable. If these steep areas are irrigated, application rates should be kept light to prevent erosion. Potatoes is another crop that is grown under irrigation.

Permeability, slope, and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. The steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Sites for dwellings need to be carefully selected or the design and method of construction need to be tailored to the site because of slope. Local streets and roads should be designed to avoid the damage resulting from frost action and low strength. Dustiness is a concern if these soils are used for recreational areas that are subject to heavy foot traffic. Slope limits the choice of locations for recreational facilities, such as picnic areas, campgrounds, and playgrounds.

This soil is in capability subclass IV_e irrigated and III_{le} nonirrigated.

57-Tetonia silt loam, 12 to 20 percent slopes. This deep, well drained soil is on dissected plateaus. It formed in silty windlaid material. Elevation is 5,700 to 7,000 feet. The mean annual precipitation is about 14 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 75 days.

Typically, the surface layer is grayish brown silt loam about 10 inches thick. The subsoil is brown silt loam about 12 inches thick. The substratum is light brownish gray, violently effervescent silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Ard, Greys, Lantonia, and Ririe silt loams; all with slopes of 12 to 20 percent. Also included are small areas with slopes more than 20 percent.

Permeability of this Tetonia soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is rapid, and the hazard of erosion is high.

This soil is mainly used for nonirrigated winter wheat. Nonirrigated spring wheat is grown at elevations above 6,500 feet. Some nonirrigated barley and alfalfa hay are also grown. If properly managed, this soil produces good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent

the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

This soil is not currently irrigated. Slopes of 12 to 20 percent make this soil marginal for irrigation.

Slope and low strength are the main limitations for urban uses. Steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Because of slope, sites for dwellings need to be carefully selected or the design and method of construction need to be tailored to the site. Local streets and roads should be designed to avoid the damage resulting from frost action and low strength. Slopes should also be taken into consideration when choosing locations for streets and roads. Steep slopes also severely limit the choices of locations for recreational areas, such as campgrounds and picnic areas. Dustiness is a concern when paths and trails are subject to heavy use.

This soil is in capability subclass IIle nonirrigated.

58-Tetonia-Ririe silt loams, 4 to 12 percent slopes.

This complex is on dissected plateaus. The soils in this complex are well drained. They formed in silty windlaid material. Elevation is 5,700 to 7,000 feet. The mean annual precipitation is about 16 inches, the mean annual air temperature is about 39 degrees F., and the average frost-free period is about 75 days.

This complex is about 55 percent Tetonia silt loam and about 40 percent Ririe silt loam. The remaining 5 percent is Lantonia and Greys silt loams, both with slopes of 4 to 20 percent, and small areas of Tetonia and Ririe soils with slopes of more than 12 percent.

Typically, the Tetonia soil has a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is brown silt loam about 12 inches thick. The substratum is light brownish gray, violently effervescent silt loam to a depth of more than 60 inches.

Permeability of this Tetonia soil is moderate. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate. Effective rooting depth is more than 60 inches.

Typically, the Ririe soil has a surface layer of grayish brown silt loam about 9 inches thick. The underlying material is pale brown and light gray, violently effervescent silt loam to a depth of more than 60 inches.

Permeability of this Ririe soil is moderate. Available water capacity is high. Surface runoff is rapid, and the hazard of erosion is moderate. Effective rooting depth is more than 60 inches.

The soils in this complex are mainly used for nonirrigated winter wheat. Nonirrigated spring wheat is grown in areas at elevations of more than 6,500 feet (fig. 15). Some nonirrigated barley and alfalfa hay are also grown. If properly managed, these soils produce good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilizer and weed control programs, and practices to

control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

These soils are not currently irrigated, but areas with slopes less than 8 percent are suited to sprinkler irrigation. Another crop that can be grown under irrigation is potatoes.

Permeability, slope, and low strength are the main limitations for urban uses. The restricted permeability of these soils reduces their effectiveness for septic tank filter fields. Steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Where slopes are more than 8 percent, sites for dwellings need to be carefully selected or the design and method of construction need to be tailored to the site. Local streets and roads should be designed to avoid the damage resulting from frost action and low strength. Dustiness is a concern if these soils are used for recreational areas that are subject to heavy foot traffic.

This complex is in capability subclass IVe irrigated and IIle nonirrigated.

59-Tetonia-Ririe silt loams, 12 to 20 percent slopes.

This complex is on dissected plateaus. The soils in this complex are deep and well drained. They formed in silty windlaid material. Elevation is 5,700 to 7,000 feet. The mean annual precipitation is about 16 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 75 days.

The Tetonia soil is on the northern and eastern exposures and makes up about 55 percent of the complex. The Ririe soil is on the southern and western exposures and ridgetops and makes up to 40 percent of the complex. About 5 percent of this complex is Lantonia silt loam. Also included are small areas with slopes more than 20 percent.

Typically, the Tetonia soil has a surface layer of grayish brown silt loam about 10 inches thick. The subsoil is brown silt loam about 12 inches thick. The substratum is light brownish gray, violently effervescent silt loam to a depth of more than 60 inches.

Permeability of this Tetonia soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is rapid, and the hazard of erosion is high.

Typically, the Ririe soil has a surface layer of grayish brown silt loam about 10 inches thick. The underlying material is pale brown, light gray, and white, violently effervescent silt loam to a depth of more than 60 inches.

Permeability of this Ririe soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is rapid, and the hazard of erosion is high.



Figure 15.-Wheat stubble on Tetonia and Ririe soils in the foreground. In the background are Greys and Turnerville soils under woodland vegetation.

The soils in this complex are mainly used for nonirrigated winter wheat. Spring wheat is grown in areas at elevations of more than 6,500 feet. Some barley and alfalfa hay are also grown. If properly managed, these soils produce good yields of all adapted crops. An effective conservation program is one that includes an adequate crop rotation, suitable fertilization and weed control programs, and practices to control erosion. An adequate conservation program can be achieved by the use of a grain-fallow rotation if minimum tillage is used and crop residue is returned to the soil. Grassed waterways help to prevent the formation of gullies. Other desirable practices for erosion control are contour farming, using gradient terraces, and field stripcropping.

Permeability, slope, and low strength are the main limitations for urban uses. The restricted permeability of these soils reduces their effectiveness for septic tank filter fields. Steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Because of slope, sites for dwellings need to be carefully selected or the design and method of construction need to be tailored to the site. Local streets and roads should be designed to avoid the damage resulting from frost action and low strength. Slopes should also be taken into consideration when locating sites for streets and roads. These slopes severely limit the choice of locations for recreational areas, such as picnic areas and campgrounds. Dustiness is a concern where paths and trails are subject to heavy use.

This complex is in capability subclass IIIe nonirrigated.

60-Turnerville silt loam, 2 to 20 percent slopes.

This deep, well drained soil is on dissected plateaus and formed in silty windlaid material. Elevation is 5,700 to 7,000 feet. The mean annual precipitation is about 20 inches, the mean annual air temperature is about 39 degrees F., and the frost-free period is about 60 days.

Typically, the surface layer is light brownish gray and light gray silt loam about 6 inches thick overlain by a 1 to 3-inch mat of decomposed or partially decomposed leaves and twigs. The subsurface layer is light gray silt loam about 10 inches thick. The upper part of the subsoil is light gray and pinkish gray silty clay loam about 41 inches thick. The lower part of the subsoil is light brownish gray silt loam to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Greys silt loam with slopes of 12 to 20 percent and Lantonia silt loam with slopes of 2 to 12 percent. Also included are small areas with slopes more than 20 percent and wet soils along streams with slopes of 0 to 4 percent.

Permeability of this Turnerville soil is moderate. Effective rooting depth is more than 60 inches. Available water capacity is high. Surface runoff is medium to rapid, and the hazard of erosion is moderate or high.

This soil is used for woodland, wildlife habitat, and recreation. The potential native vegetation consists

mainly of lodgepole pine, pinegrass, mountain brome, and other understory vegetation. Some areas also have scattered quaking aspen. The only commercial woodland use for this Turnerville soil is the harvesting of lodgepole pine for the production of posts and poles.

Permeability, slope, and low strength are the main limitations for urban uses. The restricted permeability of this soil reduces its effectiveness for septic tank filter fields. Steep slopes are a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Where slopes are more than 8 percent, sites for dwellings need to be carefully selected or the design and method of construction need to be tailored to the site. Local streets and roads should be designed to prevent the damage resulting from frost action and low strength. Slope is a limitation for recreational facilities, such as picnic areas and campgrounds.

This soil is in capability subclass IVe nonirrigated.

61-Typic Psammaquents, nearly level. These deep, very poorly drained soils are on river terraces. The soils formed in alluvium from mixed sources deposited by the Snake River and its tributaries. Slopes are 0 to 1 percent. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 41 degrees F., and the frost-free period is about 105 days.

The surface layer and underlying layers are mainly sand and loamy sand.

Included with these soils in mapping are small areas of Grassy Butte loamy sand, 0 to 1 percent slopes, and small areas of a soil that is 20 to 40 inches deep over sand and gravel.

Permeability of these Typic Psammaquents is moderately slow. Effective rooting depth is more than 60 inches. A water table fluctuates at a depth of 6 to 20 inches. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is high. Most areas of these soils are subject to an occasional, brief period of flooding early in spring.

These soils are mainly used for native pasture. Native grass hay is harvested some years. The high water table is the main limitation for cropland. The high water table and flooding are the main limitations for urban uses.

These soils are in capability subclass Vw.

62-Wardboro gravelly sandy loam. This deep, somewhat excessively drained soil is on river terraces. It formed in mixed alluvium from the Snake River and its tributaries. It is shallow to sand and gravel. Slopes are 0 to 1 percent. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 41 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is light brownish gray gravelly sandy loam about 2 inches thick. The upper part of the underlying material is light brownish gray gravelly sandy loam about 10 inches thick. The lower part is sand

and gravel to a depth of 60 inches. Depth to sand and gravel ranges from 10 to 20 inches.

Included with this soil in mapping are small areas of Bannock loam, Harston gravelly sandy loam, Heiseton loam, and Wardboro gravelly loam or gravelly sandy loam; all with slopes of 0 to 1 percent.

Permeability of this Wardboro soil is rapid in the upper part and very rapid in the sand and gravel. Effective rooting depth is more than 60 inches. Available water capacity is very low. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated alfalfa hay, wheat, barley, and pasture. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation includes pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa seeded back into the second year grain stubble.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Sprinkler irrigation is suitable for all crops, but it is not widely used.

The very rapid permeability of the underlying sand and gravel is the main limitation for urban uses. Designs for septic tank filter fields, sanitary landfills, and sewage lagoons should allow for the very rapid permeability in the underlying sand and gravel, which can cause contamination of underground water sources. The high content of sand and gravel creates a hazard of cutbanks caving in shallow excavations. The establishment of recreational areas on this soil is mainly limited by the content of gravel in the surface layer.

This soil is in capability subclass IVs irrigated.

63-Wardboro gravelly loam. This deep, somewhat excessively drained soil is on river terraces and flood plains. It formed in mixed alluvium from the Snake River and its tributaries. It is shallow to sand and gravel. Slopes are 0 to 1 percent. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 41 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is light brownish gray gravelly loam about 7 inches thick. The upper part of the underlying material is light brownish gray gravelly sandy loam 5 inches thick, and the lower part is sand and gravel to a depth of 60 inches or more. Depth to sand and gravel ranges from 10 to 20 inches.

Included with this soil in mapping are small areas of Bannock loam, Harston loam, Heiseton loam, and Wardboro gravelly sandy loam; all with slopes of 0 to 1 percent. Also included are small areas of a soil that is similar to the Wardboro soil but has lime accumulation and another soil that is similar but has a gravelly silt loam surface layer.

Permeability of this Wardboro soil is rapid in the upper part and very rapid in the sand and gravel. Effective

rooting depth is more than 60 inches. Available water capacity is very low. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, spring wheat, barley, and pasture. If properly managed, this soil produces good yields of all adapted crops. A good conservation program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation includes pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa hay seeded back into the second year grain stubble.

Border and furrow irrigation are the methods most widely used. The border method is best suited to hay, pasture, and grain crops. Sprinkler irrigation is suitable for all crops, but it is not widely used. The content of gravel throughout the profile reduces available water capacity and causes these soils to be droughty.

Permeability is the main limitation for urban uses. Designs for septic tank filter fields, sanitary landfills, and sewage lagoons should allow for the very rapid permeability in the underlying sand and gravel, which can cause contamination of underground water sources. The high content of sand and gravel creates a hazard of cutbank caving in shallow excavations. Gravel in the surface layer is the main limitation for establishing recreational facilities on this Wardboro soil.

This soil is in capability subclass IVs irrigated.

64-Withers silty clay loam. This deep, somewhat poorly drained soil is on river terraces and flood plains. It formed in mixed alluvium and is moderately deep to sand and gravel. Slopes are 0 to 1 percent. Elevation is about 4,800 feet. The mean annual precipitation is about 12 inches, the mean annual air temperature is about 41 degrees F., and the frost-free period is about 105 days.

Typically, the surface layer is grayish brown silty clay loam about 7 inches thick. The subsoil is grayish brown and pale brown silty clay loam about 19 inches thick. The upper part of the substratum is pale brown very gravelly loamy sand about 10 inches thick, and the lower part is sand and gravel to a depth of 60 inches or more. Depth to sand and gravel ranges from 20 to 36 inches. A water table is at a depth of 2 to 4 feet in summer and early in fall.

Included with this soil in mapping are small areas of Blackfoot silt loam, Bannock silty clay loam, and Labenzo silt loam; all with slopes of 0 to 1 percent. Included along the Fremont County line, in T. 7 N., R. 40 E., are areas that contain 15 to 25 percent gravel in the upper part of the profile.

Permeability of this Withers soil is moderately slow in the upper part and very rapid in the sand and gravel. Effective rooting depth is more than 60 inches. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated alfalfa hay, wheat, barley, and pasture. If properly managed, this soil produces good yields of all adapted crops. A good conservation

program is one that includes an adequate crop rotation and suitable fertilization and weed control programs. A suitable rotation includes pasture or alfalfa hay for 4 to 6 years and grain for 2 years, with pasture or alfalfa hay, seeded back into the second year grain stubble.

Border, furrow, and corrugation irrigation are the methods most widely used. Border method is best suited to hay, pasture, and grain crops. Sprinkler irrigation is suitable for all crops, but it is not widely used. Regardless of the irrigation method used, water should be applied carefully to avoid a perched water table in the moderately slowly permeable subsoil.

Low strength, shrink-swell, and slow permeability are the main limitations for urban and recreational development. Dwelling and road designs should be modified to offset low strength. The moderately slow permeability of this soil is a severe limitation for septic tank filter fields. Wetness and the clay loam surface layer limit the choice of locations for recreational facilities, such as campgrounds and picnic areas.

This soil is in capability subclass IIw irrigated.

65-Xerofluvents, channeled. These deep, well drained and moderately well drained soils are on river terraces near the Snake River. Slopes are 0 to 1 percent. These soils formed in alluvium from mixed sources. Elevation is about 5,800 feet. The mean annual precipitation is about 11 inches, the mean annual air temperature is about 41 degrees F., and the frost-free period is about 105 days.

The surface layer is grayish brown, light brownish gray, or pale brown sand, loamy sand, or sandy loam. It is gravelly, very gravelly, cobbly, or very cobbly. All material above the sand and gravel is extremely variable. At intervals of about 50 feet, old channels about 2 feet deep occur. These channels are about 15 feet wide.

Included in mapping with these soils are small areas of Wardboro, Harston, and Heiseton soils; each with a variety of surface textures.

Permeability of the Xerofluvents is moderately rapid. Effective rooting depth is more than 60 inches. Available water capacity is very low. Surface runoff is slow, and the hazard of erosion is slight.

These soils are mainly used for nonirrigated pasture, although a few small areas have been cleared and are in cropland. The native vegetation consists mainly of cottonwood, willow, and understory grasses.

Most areas of these soils are subject to occasional, brief periods of flooding early in spring. The main limitation for urban development is flooding. Most areas, however, can be used for recreation during the summer.

These soils are in capability subclass VI_s.

Use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land

uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soil maps for detailed planning." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1967, approximately 172,000 acres in the area was used for crops (6). Of this total, approximately 25,000 acres was used for row crops, mainly potatoes; 78,000 acres for close grown crops, mainly wheat and barley; 44,000 acres was in summer fallow; 22,000 acres was used for rotation hay or pasture; and the rest was idle cropland.

In Madison County Area there are areas of land that are suitable for cultivation. If irrigation is made available.

Some other small areas of good soil are surrounded by lava and are unfeasible to farm under present day methods. In the future, these areas could contribute to the production of food. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Acreage of crops has been increasing gradually as privately owned rangeland is being cultivated and irrigated by sprinklers. The use of this soil survey to help make land use decisions that will influence the future role of farming in the county is discussed in the section "General soil map for broad land use planning."

Soil erosion is the major soil problem on about 64 percent of the combined farmed and farmable land.

If slope is more than 2 percent, erosion is a hazard. Rexburg, Pocatello variant, Ririe, and Tetonia soils, for example, have map units with slopes of more than 2 percent. Soils with a surface layer of loamy sand or sand have a high hazard of soil blowing regardless of slope. Grassy Butte soils are the main soils of this group. They also have an additional trafficability problem and require machinery with more than normal traction.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a duripan, as in the Panmod soils, or soils with bedrock at a depth less than 40 inches, as in Ard, Karlan, and Modkin soils. These soils have a layer in or below the substratum that restricts the depth of the rooting zone. Productivity is reduced when the lime substratum of the Pocatello variant, Ririe, and similar soils are exposed because of erosion. Second, some erosion on farmland results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold erosion losses to amounts that

do not reduce the productive capacity of the soil. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land, provide nitrogen, and improve tilth for the following crop. Minimizing tillage and leaving crop residue on the surface of the soil help to increase infiltration and reduce the hazard of runoff and erosion.

Terraces and diversions reduce the length of slope, thereby reducing runoff and erosion. They are most practical on deep, well drained soils that have regular slopes. Lantonia, Rexburg, Ririe, and Tetonia soils are suitable for terraces.

Contour farming is a widespread erosion control practice in the survey area. It is best adapted to soils with smooth, uniform slopes, including most areas of the sloping Lantonia, Panmod, Pocatello variant, Rexburg, Ririe, and Tetonia soils.

Soil blowing is a hazard on the sandy Grassy Butte soil. Soil blowing can damage this soil in a few hours if winds are strong and the soil is dry and bare of vegetation and surface mulch. Maintaining vegetative cover and surface mulch on rough surfaces through proper tillage minimizes soil blowing on this soil. Windbreaks of adapted trees and shrubs, such as Russian-olive, Tatarian honeysuckle, and hybrid poplar, are effective in reducing soil blowing on this soil.

Information concerning the design of erosion control practices for each kind of soil is contained in the Technical Guide available in local offices of Soil Conservation Service.

Soil drainage is a management need in some areas of this county area. Some soils are naturally so wet that the production of crops common to the area is generally impossible. These soils are the poorly drained and very poorly drained typic Psammaquents and Haplaquolls. Labenzo and Withers soils have a similar problem, but it is not as serious.

Blackfoot and Labenzo soils are among those that normally have a water table at a depth of 2 to 5 feet. When an excessive amount of irrigation water is applied to these soils, the water table tends to rise. This excess water, in addition to causing seepage from canals and ditches, causes the water to seep into basements and depressions. This problem can generally be improved by applying no more water than what can be used by the crops.

Soils with underlying layers that have restricted permeability have a problem with water draining through these layers; Annis and Blackfoot soils are examples. Irrigation water penetrates the surface layer faster than the lower layers, causing water to perch for a significant period of time. If excessive irrigation water is applied, damage to crops results. Information on drainage design for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil fertility is relatively high in most soils in the survey area. All soils respond to the application of nitrogen and phosphate. No significant areas have proved to be deficient in potash or trace elements. High lime content in some soils makes iron unavailable causing chlorosis in some trees and shrubs. The Cooperative Extension Service can assist in determining the kinds and amounts of fertilizer to apply.

Soil tilth is an important factor in the germination of seeds and in the filtration of water into the soil. Soils with good tilth are granular and porous.

Tilth is a problem in the soils that stay wet late in spring. If the soils are plowed when wet, they tend to be very cloddy when dry; and good seedbeds are difficult to prepare. Fall plowing generally results in good tilth in spring.

Potatoes is the major row crop, and small areas are used for growing sugar beets. Wheat, barley, and oats, to a lesser extent, are the common close-grown crops. Alfalfa hay or an alfalfa-grass mixture is grown for the hay crop.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible

but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, Ie. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Rangeland

John Davis, range conservationist, Soil Conservation Service, helped prepare this section.

Of the 259,000 acres in the Madison County soil survey area, approximately 5 percent is federal land that

is mainly managed by the Bureau of Land Management. Practically all of this is classified as native rangeland. About 53,500 acres, or 21 percent of the total acreage in the area, is presently classified as rangeland and is either private or state endowment land under state or private management. Therefore, about 67,000 acres or 26 percent of the survey area is considered range.

Commercial cow-calf operations are the main livestock enterprises in the area. There are also some purebred cattle, dairy, and sheep operations within the survey area. Some of the range is used by operators who are not based within the county. The forage produced on rangeland is used mainly in spring and fall, with light use in summer.

An increase in range forage production can be achieved more quickly by using one or more range management practices, such as a planned grazing system, brush management, fencing, water development, use by different classes of livestock, and reseeding where feasible. The practices used or recommended for use should be coordinated with the soil, range site, and specific type of operation.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for each soil in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year,

growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation-the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. In the survey area,

supplemental water is needed for adequate growth and tree survival. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology;

(6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building site development

Table 8 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary facilities

Table 9 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 9 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the

surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent (8). Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 9 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill-trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 9 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction materials

Table 10 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor*. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet.

Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Table 11 gives information on the soil properties and site features that affect water management.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a

slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Recreation

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 12, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 12 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 9 and interpretations for dwellings without basements and for local roads and streets in table 8.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding

during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife habitat

The wildlife in Madison County consists of jackrabbits, coyote, mule deer, elk, moose, ringneck pheasant, mourning dove, sage grouse, waterfowl, shore birds, songbirds, and various birds of prey.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 13, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places.

Moderately intensive management is required for satis-

factory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, brome grass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are goldenrod, beggarweed, and wheatgrass.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountain mahogany, bitterbrush, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, saltgrass, cordgrass, cattails, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sage grouse, meadowlark, and lark bunting.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features and data obtained from physical and chemical laboratory analyses of soils.

Engineering index properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have

layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (2) and the system adopted by the American Association of State Highway and Transportation Officials (1).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dryweight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent.

Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the

soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

- 4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Soil and water features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission (5).

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, -by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, per-

meability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel; the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (7). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Flu*, meaning river, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrange-

ment, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is. Xerofluvents (*Xero*, meaning dry, plus *fluvent*, the suborder of the Entisols formed on river flood plains in recent material).

SUBGROUP. Each great group has a typical subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aquic* identifies the subgroup that typifies the great group. An example is Aquic Xerofluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, calcareous, frigid Aquic Xerofluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil series and morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (4). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (7). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Annis series

The Annis series consists of deep, moderately well drained soils on river terraces. These soils formed in mixed alluvium. Slope ranges from 0 to 1 percent. Mean annual precipitation is about 12 inches, and the mean annual air temperature is about 42 degrees F.

Annis soils are near Blackfoot, Bockston, Heiseton, Labenzo, and Withers soils. Blackfoot and Bockston soils have an average of 18 to 27 percent clay in the control section. Blackfoot and Withers soils are somewhat poorly drained and have a fluctuating water table at a depth of about 3 to 5 feet. The Labenzo soils have 18 to 27 percent clay, and the depth to sand and gravel is 40 inches. Heiseton soils have an average of less than 18 percent clay in the control section.

Typical pedon of Annis silty clay loam, from Jefferson County, Idaho; 1 mile north of Menan; 1,000 feet south and 75 feet east of the northwest corner of sec. 27, T. 5 N., R. 38 E.

Ap-0 to 7 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; hard, friable, sticky, plastic; many very fine, fine, and medium roots; common very fine and fine interstitial pores; slight effervescence; moderately alkaline; abrupt smooth boundary.

A12-7 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; slight effervescence; moderately alkaline; abrupt smooth boundary.

B2-12 to 21 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few fine distinct mottles of dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to weak thin and medium platy; slightly hard, friable, slightly sticky, slightly plastic; common very fine, fine and medium roots; many very fine and fine tubular pores; slight effervescence; moderately alkaline; gradual wavy boundary.

C1ca-21 to 31 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few fine distinct mottles of dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to weak very fine and fine subangular blocky; hard, friable, sticky, plastic; few very fine and fine roots; many very fine and fine tubular pores; slight effervescence with few lime splotches; moderately alkaline; clear wavy boundary.

C2ca-31 to 38 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; many fine distinct mottles of dark brown (10YR 3/3) moist; weak very fine subangular blocky structure;

hard, friable, sticky, plastic; few very fine and fine roots; many very fine and fine tubular pores; strong effervescence; moderately alkaline; abrupt wavy boundary.

C3ca-38 to 49 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; few fine prominent mottles of dark yellowish brown (10YR 3/4) moist; weak very fine subangular blocky structure; hard, friable, sticky, very plastic; few very fine and fine roots; many very fine and fine tubular pores; strong effervescence; moderately alkaline; clear wavy boundary.

C4ca-49 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; common medium distinct mottles of dark yellowish brown (10YR 3/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; violent effervescence; moderately alkaline.

These soils have a water table that fluctuates from a depth of 3 to 5 feet in summer and early in fall. Mottles are commonly below a depth of 20 inches. The control section averages 27 to 35 percent clay and less than 15 percent fine sand or coarser,

The Ap horizon has value of 2 or 3 moist and chroma of 1 or 2. The Cca horizon has hue of 10YR or 2.5Y. Some pedons have strata of loam and sandy loam.

Ard series

The Ard series consists of moderately deep well drained soils on dissected plateaus. These soils formed in loess over and mixed with residuum from rhyolite. Slope ranges from 4 to 12 percent. The mean annual precipitation is about 15 inches, and the mean annual air temperature is about 39 degrees F.

Ard soils are near Karlan, Lantonia, Ririe, Swanner, and Tetonia soils. Karlan, Lantonia, and Tetonia soils have a mollic epipedon thicker than 16 inches. Lantonia, Ririe, and Tetonia soils do not have bedrock within a depth of 40 inches. Swanner soils have bedrock at a depth of 10 to 20 inches.

Typical pedon of Ard flaggy silt loam, 4 to 12 percent slopes; about 50 feet south and 1,305 feet west of the northeast corner of sec. 7., T. 5 N., R. 43 E.

A11-0 to 9 inches; dark grayish brown (10YR 4/2) flaggy silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine and medium granular; slightly hard, friable, slightly sticky, slightly plastic; many fine and few medium and coarse roots; many fine tubular pores; mildly alkaline; gradual wavy boundary.

A12-9 to 12 inches; grayish brown (10YR 5/2) flaggy silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; very hard, firm, slightly sticky, plastic; common fine and

few medium roots; many fine tubular pores; slight effervescence because of mixing by rodents; moderately alkaline; clear wavy boundary.

IIC1ca-12 to 21 inches; white (10YR 8/1) flaggy silt loam, light gray (10YR 7/2) moist; weak fine and medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; common fine, few medium and coarse roots; many fine tubular pores; violent effervescence with lime coatings on rhyolitic tuff fragments; mildly alkaline; clear irregular boundary.

IIC2ca-21 to 25 inches; grayish brown (10YR 5/2) flaggy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and few medium and coarse roots; violent effervescence with lime coatings on rhyolitic tuff fragments; moderately alkaline; abrupt irregular boundary.

IIR-25 inches; fractured rhyolitic tuff.

Depth to bedrock ranges from 20 to 40 inches. Rock fragments are common in the profile but occupy less than 35 percent of any horizon. The soil is mildly alkaline to strongly alkaline in the lower horizons. The mollic epipedon ranges from 10 to 16 inches in thickness. The A horizon has value of 2 or 3 moist and chroma of 2 or 3. The Cca horizon contains 15 to 30 percent calcium carbonate equivalent.

Bannock series

The Bannock series consists of deep, well drained soils on river terraces. These soils formed in mixed alluvium and are moderately deep over sand and gravel. Slope ranges from 0 to 1 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 42 degrees F.

Bannock soils are near Bockston, Harston, Heiseton, Labenzo, and Wardboro soils. Bockston and Heiseton soils are 40 to 60 inches deep over sand and gravel. In addition, Heiseton soils do not have a mollic epipedon. Harston soils do not have a calcic horizon or a mollic epipedon. Labenzo soils contain an average of 18 to 27 percent clay in the control section and are moderately well drained. Wardboro soils are less than 20 inches deep over sand and gravel.

Most areas of these Bannock soils have slightly finer textures than the Bannock soils mapped in other survey areas. However, this does not affect use or management.

Typical pedon of Bannock loam, 1/4 mile north of Archer store; 860 feet north and 50 feet east of the southwest corner of sec. 32, T. 5 N., R. 40 E.

A1-0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine, fine,

medium, and coarse roots; common very fine, and fine interstitial pores; slight effervescence; moderately alkaline; clear wavy boundary.

B1-7 to 9 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine subangular blocky structure; hard, friable, slightly sticky, plastic; common very fine, fine and medium and few coarse roots; many very fine and fine tubular pores; slight effervescence; moderately alkaline; clear wavy boundary.

B2-9 to 15 inches; light brownish gray (10YR 6/2) loam, brown (10YR 5/3) moist; moderate, medium prismatic structure parting to moderate medium and coarse subangular blocky; slightly hard, friable, sticky, plastic; common very fine and fine roots; many very fine and fine tubular pores; slight effervescence; moderately alkaline; clear wavy boundary.

C1ca-15 to 21 inches; white (10YR 8/2) silt loam, light brownish gray (10YR 6/2) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine, fine and medium tubular pores; violent effervescence; moderately alkaline; clear wavy boundary.

IIC2-21 to 25 inches; light brownish gray (10YR 6/2) gravelly loam, brown (10YR 4/3) moist; massive; soft, friable, slightly sticky, slightly plastic; common very fine and fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

IIIC3-25 to 60 inches; gray (10YR 6/1) sand and gravel, dark grayish brown (10YR 4/2) moist; loose; few very fine and fine roots; about 75 percent gravel; strong effervescence; moderately alkaline.

The mollic epipedon is 7 to 12 inches thick. Between depths of 10 and 20 inches the soil is dominantly loam, silt loam, gravelly loam, or gravelly sandy loam. Stratification with material coarser than very fine sand is below a depth of 20 inches in some pedons. These soils contain more than 18 percent clay in the control section and are outside the range of characteristics for the Bannock series. However, this does not affect use or management.

Blackfoot series

The Blackfoot series consists of deep, somewhat poorly drained soils on river terraces and flood plains. These soils formed in mixed alluvium. Slope ranges from 0 to 1 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 42 degrees F.

Blackfoot soils are near Annis, Bockston, Harston, Heiseton, Labenzo, and Withers soils. Annis and Withers soils have an average of 27 to 35 percent clay in the control section. Labenzo and Harston soils are 20 to 40 inches deep over sand and gravel. Bockston soils have

a calcic horizon. Heiseton soils have a sandy loam profile and have an average of less than 18 percent clay.

Typical pedon of Blackfoot silt loam from Jefferson County, Idaho; 5 miles north and 1 mile west of Rigby; 1,040 feet south and 40 feet east of the northwest corner of sec. 24, T. 5 N., R. 38 E.

Ap-0 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine common medium roots; many very fine and fine interstitial pores; slight effervescence; mildly alkaline; abrupt smooth boundary.

C1-10 to 16 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few fine faint brown mottles (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine and fine and few medium and coarse tubular pores; slight effervescence; mildly alkaline; abrupt wavy boundary.

C2-16 to 22 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few fine faint brown mottles (10YR 4/3) moist; massive; hard, friable, sticky, plastic; few very fine and fine roots; many very fine and fine tubular pores; slight effervescence; mildly alkaline; abrupt wavy boundary.

C3ca-22 to 35 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; common fine distinct dark yellowish brown mottles (10YR 4/4) moist; massive; slightly hard, friable, sticky, plastic; few very fine and fine roots; many very fine tubular pores; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC4-35 to 42 inches; light brownish gray (10YR 6/2) sandy loam, brown (10YR 5/3) moist; common fine distinct dark yellowish brown mottles (10YR 4/4) moist; massive; soft, friable; few very fine and fine roots; many very fine and fine tubular pores; slight effervescence; moderately alkaline; abrupt wavy boundary.

IIIC5-42 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; common fine distinct dark yellowish brown mottles (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky; few very fine and fine roots; many very fine and fine tubular pores; slight effervescence; moderately alkaline.

These soils have a water table that fluctuates between depths of 2 and 4 feet in summer and early in fall. In most pedons the mottles are below a depth of 20 inches.

The Ap horizon has hue of 2.5Y or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 1 or 2. The C horizon is dominantly medium textured above a depth of

40 inches, has slight effervescence or strong effervescence, and contains less than 15 percent carbonates.

Bockston series

The Bockston series consists of deep, well drained soils on river terraces. These soils formed in mixed alluvium and are deep to sand and gravel. Slope ranges from 0 to 1 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 42 degrees F.

Bockston soils are near Annis, Bannock, Blackfoot, Harston, Heiseton, and Labenzo soils. Bannock, Harston, and Labenzo soils are 20 to 40 inches deep over sand and gravel. Annis soils contain 27 to 35 percent clay in the control section. Heiseton soils contain less than 18 percent clay in the control section and have an irregular decrease in organic matter content above a depth of 50 inches. Blackfoot soils are somewhat poorly drained, with a fluctuating water table at a depth of 2 to 4 feet and do not have a calcic horizon.

Typical pedon of Bockston loam, about 6 miles southeast of Thornton, 2,040 feet south and 110 feet west of the northeast corner of sec. 16, T. 4 N., R. 40 E.

Ap-0 to 10 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; soft, friable, slightly sticky, slightly plastic; few fine, medium and coarse roots; common very fine and fine interstitial pores; slight effervescence; mildly alkaline; abrupt smooth boundary.

B2-10 to 21 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few fine and medium roots; common very fine and fine and few medium tubular pores; slight effervescence; mildly alkaline; clear smooth boundary.

C1ca-21 to 29 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; common very fine, fine, and medium tubular pores; strong effervescence; moderately alkaline; clear wavy boundary.

C2ca-29 to 38 inches; white (10YR 8/2) silt loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; common very fine, fine, and medium tubular pores; violent effervescence; moderately alkaline; clear wavy boundary.

C3ca-38 to 50 inches; white (10YR 8/2) fine sandy loam, light brownish gray (10YR 6/2) moist; massive; hard, firm, slightly sticky, slightly plastic; common very fine, fine, and medium tubular pores; violent effervescence; moderately alkaline; clear wavy boundary.

IIC4-50 to 60 inches; white (10YR 8/2) sand, gravel, and cobbles, violent effervescence.

The A horizon is mildly alkaline or moderately alkaline and has slight effervescence or moderate effervescence. The B horizon, if present, has value of 6 or 7 dry and 4 to 6 moist.

Bondbranch series

The Bondbranch series consists of shallow, well drained soils on basalt plains. These soils formed in sandy wind-laid material derived from mixed sources. Slope ranges from 0 to 12 percent. The mean annual precipitation is about 10 inches, and the mean annual air temperature is about 42 degrees F.

Bondbranch soils are near Grassy Butte, Mathon, and Modkin soils. Grassy Butte and Mathon soils are more than 40 inches deep to bedrock. Grassy Butte soils also have a 10 to 40 inch control section that is predominantly sand or loamy sand. Modkin soils are 20 to 40 inches deep over bedrock.

Typical pedon of Bondbranch extremely stony sandy loam, from an area of Rock outcrop-Bondbranch complex, 2 to 40 percent slopes; about 8 miles west of Rexburg; 1,800 feet east and 100 feet north of the southwest corner of sec. 23, T. 6 N., R. 38 E.

A1-0 to 6 inches; grayish brown (10YR 5/2) extremely stony sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine granular structure; soft, very friable; common very fine and fine roots; many very fine interstitial pores; mildly alkaline; clear wavy boundary.

B2-6 to 10 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, medium and fine subangular blocky structure; soft, very friable; common very fine and fine roots; many very fine tubular pores; slight effervescence; mildly alkaline; clear wavy boundary.

B3-10 to 15 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine subangular blocky structure; soft, very friable; few very fine and common fine roots; many very fine tubular pores; strong effervescence; moderately alkaline; clear wavy boundary.

Cca-15 to 18 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; few very fine and fine roots; common very fine tubular pores; strong effervescence; moderately alkaline; abrupt irregular boundary.

IIR-18 inches; basalt.

The control section is dominantly moderately coarse textured and contains less than 35 percent rock fragments, but some pedons have thin strata of loamy sand material. Bedrock is at a depth of 10 to 20 inches.

The surface layer is dark colored mainly because of the high content of dark colored sand grains. The content of organic carbon is not high enough to meet the requirements for a mollic epipedon.

Eginbench series

The Eginbench series consists of deep, somewhat poorly drained soils on river terraces. These soils formed in sandy alluvial material derived from mixed sources and are deep to sand and gravel. Slope ranges from 0 to 1 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 42 degrees F.

Eginbench soils are near Grassy Butte soils. The Grassy Butte soils formed in windlaid sand over basalt.

Typical pedon of Eginbench loamy coarse sand, wet; 635 feet east and 450 feet south of the northeast corner of NW 1/4 SE 1/4, sec. 7, T 6 N., R. 39 E.

Ap-0 to 8 inches; brown (10YR 5/3) loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; many very fine and fine, and few medium roots; many very fine and fine interstitial pores; moderately alkaline; abrupt smooth boundary.

C1-8 to 16 inches; brown (10YR 5/3) loamy coarse sand, very dark grayish brown (10YR 3/2) moist; few medium faint dark brown mottles (7.5YR 3/2) moist; single grain; loose; many very fine roots; about 5 percent gravel; moderately alkaline; clear wavy boundary.

C2-16 to 27 inches; light brownish gray (10YR 6/2) loamy coarse sand, dark brown (10YR 4/3) moist; many large distinct dark brown mottles (7.5YR 3/2) moist; single grain; loose; few very fine roots; many very fine and fine interstitial pores; neutral; gradual wavy boundary.

C3-27 to 39 inches; light brownish gray (10YR 6/2) loamy coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose; few very fine roots; many very fine and fine pores; about 5 percent fine gravel; neutral; diffuse wavy boundary.

C4-39 to 60 inches; pale brown (10YR 6/3) coarse sand with about 10 percent fine gravel; brown (10YR 4/3) moist; single grain; loose; few very fine roots; neutral.

The surface layer does not have enough organic carbon to qualify as a mollic epipedon. The 10- to 40-inch control section is loamy coarse sand or loamy sand with less than 15 percent gravel.

The A horizon has value of 4 or 5 dry. This horizon becomes quite compact after being surface irrigated. The compaction generally results from the breakdown of soil structure and subsequent high bulk density caused by the particle-size distribution of the sand.

Mottles are at a depth of 8 to 27 inches. The water table is maintained at a depth of 1 to 3 feet by subirrigation. As more of this soil is sprinkler irrigated in the future, the water table will be lowered.

Grassy Butte series

The Grassy Butte series consists of deep, somewhat excessively drained soils on basalt plains. These soils formed in sandy windlaid material derived from mixed sources. Slope ranges from 0 to 20 percent. The mean annual precipitation is about 10 inches, and the mean annual air temperature is about 42 degrees F.

Grassy Butte soils are near Bondranch, Eginbench, Mathon, and Modkin soils. Eginbench soils formed in alluvial sands and have a fluctuating water table at a depth of 1 to 3 feet. Mathon soils have a sandy loam control section. Modkin soils have a loamy control section and are 20 to 40 inches deep over basalt. Bondranch soils are 10 to 20 inches deep over basalt.

Typical pedon of Grassy Butte loamy sand, from an area of Grassy Butte-Rock outcrop complex, 2 to 20 percent slopes; about 9 miles northwest of Rexburg; 1,640 feet south and 100 feet east of the northwest corner of sec. 27, T. 7 N., R. 38 E.

A11-0 to 3 inches; brown (10YR 5/3) loamy sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; mildly alkaline; abrupt smooth boundary.

A12-3 to 6 inches; brown (10YR 5/3) loamy sand, very dark grayish brown (10YR 3/2) moist; weak, very coarse and coarse subangular blocky structure; soft, very friable; mildly alkaline; gradual wavy boundary.

C1-6 to 32 inches; brown (10YR 5/3) loamy sand; dark brown (10YR 3/3) moist; weak, medium and coarse subangular blocky structure; soft, very friable; neutral; clear wavy boundary.

C2ca-32 to 46 inches; light brownish gray (10YR 6/2) loamy sand, dark brown (10YR 4/3) moist; single grain; loose; strong effervescence; mildly alkaline; gradual wavy boundary.

C3ca-46 to 62 inches; similar to C2ca except brown (10YR 5/3) moist; abrupt wavy boundary.

IIR-62 inches; bedrock.

These soils are generally moist but are dry at a depth of 12 to 35 inches for 45 consecutive days late in summer and in autumn. The organic carbon decreases to less than .2 percent above a depth of 16 inches.

The A horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The surface layer is dark because of a high content of dark colored sand grains.

Greys series

The Greys series consists of deep, well drained soils on dissected plateaus. They formed in silty windlaid material. Slope ranges from 12 to 30 percent. The mean annual precipitation is about 20 inches, and the mean annual air temperature is about 39 degrees F.

Greys soils are near Judkins, Lantonia, Tetonia, and Turnerville soils. Judkins soils are 20 to 40 inches deep to bedrock. Lantonia soils contain an average of 18 to

27 percent clay and have a mollic epipedon more than 16 inches thick. Tetonia soils have a mollic epipedon thicker than 16 inches. Turnerville soils do not have a mollic epipedon.

Typical pedon of Greys silt loam, from an area of Greys silt loam, 20 to 30 percent slopes; 9 miles southeast of Rexburg; 380 feet west and 180 feet south of the northeast corner of sec. 10, T. 4 N., R 41 E.

A11-0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine, few medium and coarse roots; slightly acid; clear smooth boundary.

A12-4 to 10 inches; brown (10YR 5/3) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; many very fine and fine, few medium and coarse roots; many very fine, common fine tubular pores; slightly acid; clear wavy boundary.

A13-10 to 16 inches; brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; very hard, friable, slightly sticky, slightly plastic; common very fine, few fine, medium and coarse roots; many very fine, common fine and few medium tubular pores; slightly acid; clear wavy boundary.

A2-16 to 23 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common very fine, few fine, medium and coarse roots; many very fine, common fine, few medium and coarse tubular pores; 50 percent or more of horizon has silt coats on both ped faces and interiors; medium acid; clear wavy boundary.

B21t-23 to 58 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (10YR 4/3) moist; moderate medium and coarse prismatic structure parting to strong medium and coarse subangular blocky; very hard, friable, slightly sticky, slightly plastic; common very fine, few fine, medium and coarse roots; many very fine, common fine and few medium and coarse tubular pores; few thin and common medium clay films on all ped faces; many yellow (10YR 7/8) silt coatings on ped faces; bands 1/2 inch to 1 1/2 inches wide with thick clay films comprise 20 percent of the horizon; clay band areas are brown (7.5YR 5/4) sticky and plastic silty clay loam; medium acid; gradual wavy boundary.

B22t-58 to 60 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (10YR 4/3) moist; moderate medium and coarse prismatic structure parting to weak medium and coarse subangular blocky; few fine, medium and coarse roots; many very fine, common fine and few medium and coarse tubular

pores; thin continuous clay films on matrix, thick continuous clay films in dark reddish brown (5YR 3/3) clay bands; continuous bleached yellow (10YR 7/8) silt coats on vertical faces of peds; slightly acid.

Thickness of the mollic epipedon ranges from 10 to 18 inches. Typically, these soils are noneffervescent to a depth of more than 7 feet. Content of organic carbon in the mollic epipedon ranges from .7 to 4 percent and decreases uniformly with depth. Content of coarse fragments is typically less than 1 percent. The A1 horizon has value of 2 or 3 moist and 4 or 5 dry and chroma of 1 to 3.

Harston series

The Harston series consists of deep, well drained soils on river terraces. These soils formed in mixed alluvium and are moderately deep to sand and gravel. Slope ranges from 0 to 2 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 42 degrees F.

Harston soils are near Bannock, Blackfoot, Bockston, Heiseton, Labenzo, and Wardboro soils. Bannock soils have a mollic epipedon and a calcic horizon. Bockston, Blackfoot, and Labenzo soils contain an average of 18 to 27 percent clay in the control section, and Blackfoot soils are somewhat poorly drained. Heiseton soils have an irregular decrease in the content of organic matter with depth and are more than 40 inches deep to sand and gravel. Wardboro soils are 10 to 20 inches deep to sand and gravel.

Typical pedon of Harston sandy loam, in an area of Harston sandy loam, 0 to 1 percent slopes; 1/4 mile east and 1/2 mile south of Thornton; 1,760 feet south and 1,240 feet west of the center of sec. 23, T. 5 N., R 39 E.

Ap-0 to 8 inches; light brownish gray (10YR 6/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; common very fine and fine roots; many very fine and fine interstitial pores; slight effervescence; moderately alkaline; abrupt smooth boundary.

C1-8 to 24 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; common very fine and fine roots; common very fine and fine tubular pores; slight effervescence; moderately alkaline; clearly smooth boundary.

C2-24 to 28 inches; light gray (10YR 7/2) loamy sand, brown (10YR 5/3) moist; massive; soft, very friable; common very fine and fine roots; many very fine and fine interstitial pores; slight effervescence; moderately alkaline; clear wavy boundary.

IIC3-28 to 60 inches; light brownish gray (10YR 6/2) sand and gravel, dark grayish brown (10YR 4/2)

moist; about 60 percent varicolored rounded gravel; about 20 percent black or very dark gray sand; gravel is mostly quartzite; single grain; loose; common very fine and fine roots; many very fine interstitial pores; strong effervescence; moderately alkaline.

The 10- to 40-inch control section averages less than 18 percent clay, and in most places it has less than 12 percent clay. It is less than 35 percent coarse fragments. Depth to loose sand and gravel is 25 to 40 inches. The Ap or A1 horizon is sandy loam, coarse sandy loam, loam, or gravelly sandy loam.

Heisetun series

The Heisetun series consists of deep, moderately well drained soils on river terraces and flood plains. These soils formed in mixed alluvium from the Snake River and its tributaries and are deep to sand and gravel. Slope ranges from 0 to 1 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 42 degrees F.

Heisetun soils are near Annis, Bannock, Blackfoot, Bockston, Harston, Labenzo, and Wardboro soils. Annis soils contain 27 to 35 percent clay in the control section. Bockston soils are well drained and have 18 to 27 percent clay in the control section. Blackfoot soils are somewhat poorly drained and contain 18 to 27 percent clay in the control section. Bannock, Harston, and Labenzo soils are 20 to 40 inches deep to sand and gravel, and Labenzo soils contain 18 to 27 percent clay in the control section. Wardboro soils are less than 20 inches deep to sand and gravel.

Typical pedon of Heisetun loam, about 5 miles southwest of Rexburg; 1,050 feet south and 75 feet east of the northwest corner sec. 4, T. 5 N., R. 39 E.

A1-0 to 6 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure, moderate thin platy in the upper 2 inches; soft, friable, slightly sticky; many very fine, fine, and medium roots; common very fine and fine interstitial pores; slight effervescence; moderately alkaline; clear smooth boundary.

C1-6 to 10 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; common very fine and fine tubular pores; dark color is caused by large amount of dark sand grains; slight effervescence; moderately alkaline; clear smooth boundary.

C2-10 to 14 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; slight effervescence; moderately alkaline; clear wavy boundary.

C3-14 to 20 inches; light brownish gray (10YR 6/2) loamy sand, grayish brown (10YR 5/2) moist; loose; very friable; many very fine and fine roots; slight effervescence; moderately alkaline; clear smooth boundary.

IIC4-20 to 31 inches; light brownish gray (10YR 6/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; common fine distinct strong brown mottles (7.5YR 5/6) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine, fine, and very coarse roots; many very fine and fine tubular pores; slight effervescence; moderately alkaline; abrupt smooth boundary.

IIIC5-31 to 38 inches; light brownish gray (10YR 6/2) coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose; few very fine, fine and very coarse roots; 10 percent of 5- to 20-millimeter pebbles; slight effervescence; moderately alkaline; abrupt smooth boundary.

IVC6-38 to 45 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; common medium distinct strong brown mottles (7.5YR 5/6) moist; massive; soft, very friable; few fine, medium and coarse roots; few very fine and fine tubular pores; slight effervescence; moderately alkaline; clear smooth boundary.

VC7-45 to 60 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; few fine distinct brown mottles (10YR 5/4) moist; massive; soft, very friable; common very fine, fine, and very coarse roots; slight effervescence; moderately alkaline.

Reaction is mildly alkaline or moderately alkaline, and these soils are slightly effervescent or strongly effervescent. Depth to mottles ranges from 20 to 40 inches. A water table fluctuates between a depth of 4 to 6 feet late in spring and early in summer. Strata of loam, loamy sand, sand, and sandy loam are common below a depth of 20 inches. The A horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3.

Judkins series

The Judkins series consists of moderately deep, well drained soils on rhyolite mountains. These soils formed in material weathered from rhyolite or closely related bedrock. Slope ranges from 30 to 60 percent. The mean annual precipitation is about 22 inches, and the mean annual air temperature is about 37 degrees F.

Judkins soils are near Greys and Turnerville soils. Greys and Turnerville soils are more than 40 inches deep to bedrock and formed in loess.

Typical pedon of Judkins extremely stony loam, in an area of Judkins extremely stony loam, 30 to 60 percent slopes; about 10 miles southeast of Rexburg; 1,460 feet south and 390 feet west of the northeast corner of sec. 2, T. 4 N., R. 41 E.

O-3 inches to 0; 60 percent roots and undecomposed and partially decomposed twigs and needles.

A1-0 to 6 inches; light brownish gray (10YR 6/2) extremely stony loam, very dark grayish brown (10YR 3/2) moist; moderate, medium and fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; medium acid; abrupt smooth boundary.

A2-6 to 10 inches; light gray (10YR 7/2) extremely stony loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; medium acid; clear wavy boundary.

B&A-10 to 20 inches; 70 percent pale brown (10YR 6/3) extremely stony loam, yellowish brown (10YR 5/4) moist; 30 percent light gray (10YR 7/2), brown (10YR 4/3) moist; moderate, medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and fine roots; common very fine and fine tubular pores; medium acid; clear smooth boundary.

B2t-20 to 35 inches; pale brown (10YR 6/3) extremely stony loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate, medium and coarse subangular blocky; hard, friable, slightly sticky, slightly plastic; few very fine, fine, and coarse roots; common very fine and fine tubular pores; common thin nearly continuous clay films on all surfaces; medium acid; abrupt wavy boundary.

IIR-35 to 40 inches; pinkish gray (7.5YR 7/2) fractured rhyolite.

Depth to bedrock is 20 to 40 inches. The surface horizon is commonly extremely stony loam, but ranges to very stony or flaggy silt loam. The B horizon ranges from heavy loam to heavy silt loam in some profiles and is extremely stony.

Karlan series

The Karlan series consists of moderately deep, well drained soils on dissected plateaus. These soils formed in silty windlaid material and colluvium over residuum from rhyolite and rhyolitic tuff. Slope ranges from 4 to 12 percent. The mean annual precipitation is about 17 inches, and the mean annual air temperature is about 39 degrees F.

Karlan soils are near Ard, Rammel, Ririe, and Tetonia soils. Ard soils have a coarse loamy control section. Ririe soils are more than 60 inches deep to bedrock. Tetonia soils have a calcic horizon at a depth of 17 to 35 inches. Rammel soils have an argillic horizon.

Typical pedon of Karlan silt loam, from an area of Karlan silt loam, 4 to 12 percent slopes; about 2 1/2 miles northeast of the Green Canyon swimming resort, 15 feet west and 300 feet south of the northeast corner of sec. 30, T. 6 N., R. 43 E.

Ap-0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine and fine roots; 5 percent pebbles; common tubular pores; neutral; abrupt smooth boundary.

A12-9 to 17 inches; dark grayish brown (10YR 4/2) silt loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; 5 percent pebbles; common fine and few very fine tubular pores; neutral; clear wavy boundary.

B1-17 to 25 inches; dark brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; 5 percent pebbles; common fine tubular pores; mildly alkaline; clear wavy boundary.

B2-25 to 28 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak coarse subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; common bleached silt grains on ped surfaces; neutral; clear wavy boundary.

IICca-28 to 31 inches; white (10YR 8/2) gravelly loam, pale brown (10YR 6/3) moist; weak coarse subangular blocky structure parting to weak fine granular; hard, firm, slightly sticky, slightly plastic; few very fine and fine roots; common fine tubular pores; 25 percent angular pebbles; violent effervescence; mildly alkaline; diffuse irregular boundary.

IIIR-31 inches; light gray (5YR 7/2) fractured rhyolitic tuff, gray (5YR 5/1) moist.

The mollic epipedon is 16 to 32 inches thick. Bleached silt grains are common between depths of 20 and 30 inches. Depth to bedrock is 20 to 40 inches. The A horizon has value of 3 or 4 dry.

Labenzo series

The Labenzo series consists of deep, moderately well drained soils on river terraces and flood plains. These soils formed in mixed alluvium from the Snake River and its tributaries. They are moderately deep to sand and gravel. Slope ranges from 0 to 1 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 42 degrees F.

Labenzo soils are near the Annis, Bannock, Blackfoot, Bockston, Harston, Heiseton, Wardboro, and Withers soils. Annis, Blackfoot, and Bockston soils are more than 40 inches deep to sand and gravel. Bannock soils have a regular decrease in organic carbon with depth. Harston and Heiseton soils contain less than 18 percent clay in the control section. In addition, Heiseton soils are more

than 40 inches deep to sand and gravel. Withers soils contain 27 to 35 percent clay and are somewhat poorly drained. Wardboro soils have loose sand and gravel within a depth of 20 inches.

Typical pedon of Labenzo silt loam from Jefferson County, Idaho; about 3 1/2 miles north of Rigby; 120 feet north and 250 feet east of the southwest corner of sec. 30, T. 5 N., R. 39 E.

Ap-0 to 13 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable, slightly sticky, slightly plastic; many very fine and fine roots; slight effervescence; moderately alkaline; abrupt smooth boundary.

C1-13 to 17 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; moderate thin platy structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine, fine, and medium tubular pores; slight effervescence; moderately alkaline; abrupt smooth boundary.

IIC2-17 to 21 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; few fine faint dark brown mottles (10YR 4/3) moist; massive; soft, very friable; few very fine and fine roots; many very fine, fine and medium tubular pores; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIIC3-21 to 24 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few fine faint dark brown mottles (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine, fine and medium tubular pores; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIIC4-24 to 28 inches; mixture of dark gray (10YR 4/1) and light brownish gray (10YR 6/2) silt loam, very dark brown (10YR 2/2) and dark grayish brown (10YR 4/2) moist; few faint dark yellowish brown mottles (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; slight effervescence; moderately alkaline; abrupt wavy boundary.

IVC5-28 to 34 inches; light brownish gray (10YR 6/2) lenses of 80 percent silt loam, 20 percent loamy sand, dark grayish brown (10YR 4/2) moist; few medium distinct dark yellowish brown mottles (10YR 4/4) moist; massive; soft, very friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; slight effervescence; moderately alkaline; abrupt wavy boundary.

VC6-34 to 60 inches; light brownish gray (10YR 6/2) sand and gravel, dark grayish brown (10YR 4/2) moist; single grain; loose; few very fine and fine roots; slight effervescence; moderately alkaline.

Most areas have pockets of buried surface layer material. These soils have slight to strong effervescence in most areas, but some layers are noncalcareous. At one time these soils were somewhat poorly drained, with a water table at a depth of 15 to 30 inches. Natural and artificial drainage have created the present moderately well drained condition in most profiles.

Lantonia series

The Lantonia series consists of deep, well drained soils on dissected plateaus. These soils formed in calcareous loess. Slope ranges from 0 to 12 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 39 degrees F.

Lantonia soils are near Ard, Greys, Rammel, and Tetonia soils. Ard and Rammel soils are 20 to 40 inches thick. Greys soils have a mollic epipedon that ranges from 10 to 18 inches in thickness. Tetonia soils have a calcic horizon at a depth of 16 to 35 inches.

Typical pedon of Lantonia silt loam, from an area of Lantonia silt loam, 4 to 12 percent slopes; 1,220 feet south and 780 feet west of the northeast corner of sec. 13, T. 6 N., R. 42 E.

Ap-0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; mildly alkaline; abrupt smooth boundary.

A12-7 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak very fine granular; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine and few fine tubular pores; mildly alkaline; clear wavy boundary.

A3-12 to 17 inches; brown (10YR 4/3) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak very fine granular; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine and few fine tubular pores; mildly alkaline; clear wavy boundary.

B1-17 to 21 inches; brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine and few fine tubular pores; thin patchy clay films in pores; mildly alkaline; clear wavy boundary.

B2-21 to 36 inches; brown (10YR 4/3) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine and few fine tubular pores; thin nearly continu-

ous clay films on vertical, horizontal, and pore surfaces; mildly alkaline; clear wavy boundary.

B3ca-36 to 39 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; hard, firm, slightly sticky, plastic; many very fine roots; few very fine tubular pores; thin nearly continuous clay films in pores and thin patchy clay films on vertical and horizontal faces; common lime veins; firm nodules of soil material; slight effervescence; mildly alkaline; abrupt boundary.

C1ca-39 to 50 inches; mixture of white (10YR 8/2) and very pale brown (10YR 7/3) silt loam, light brownish gray (10YR 6/2), and dark grayish brown (10YR 4/2) moist; weak thick platy structure parting to medium fine angular blocky; hard, firm, slightly sticky, plastic; few very fine and fine roots; many very fine and common fine tubular pores; mixed by worms and rodents; common lime veins; violent effervescence; moderately alkaline; abrupt wavy boundary.

C2ca-50 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; violent effervescence; moderately alkaline.

The mollic epipedon is 16 to 30 inches thick. Depth to the calcic horizon ranges from 35 to 60 inches. Common bleached silt grains and krotovinas are throughout the profile. The A horizon has value of 4 or 5 dry and 2 or 3 moist.

Mathon series

The Mathon series consists of deep, well drained soils on basalt plains. These soils formed in sandy windlaid material derived from mixed sources. Slope ranges from 0 to 20 percent. The mean annual precipitation is about 10 inches, and the mean annual air temperature is about 42 degrees F.

Mathon soils are near Bondbranch, Grassy Butte, and Modkin soils. Bondbranch soils are less than 20 inches deep to basalt bedrock. Grassy Butte soils are calcareous and have a profile that is loamy fine sand or coarser throughout. Modkin soils are 20 to 40 inches deep to basalt.

Typical pedon of Mathon loamy sand, in an area of Mathon-Rock outcrop complex, 2 to 20 percent slopes; about 1 mile southwest of Quayle Lake, 1,550 feet west and 100 feet south of the northeast corner of sec. 25, T. 7 N., R. 38 E.

A1-0 to 5 inches; brown (10YR 5/3) loamy sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; many very fine and fine roots; many very fine interstitial pores; mildly alkaline; abrupt smooth boundary.

B2-5 to 13 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak fine and medium

subangular structure; soft, very friable; many very fine and common fine roots; many very fine interstitial pores; mildly alkaline; gradual wavy boundary.

C1-13 to 55 inches; brown (10YR 5/3) sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable; few fine roots; many very fine interstitial pores; mildly alkaline; abrupt wavy boundary.

C2ca-55 to 60 inches; pale brown (10YR 6/3) sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; few fine roots; many very fine interstitial pores; 1 percent angular basalt pebbles; violent effervescence; moderately alkaline; gradual wavy boundary.

In some areas the profile contains as much as 10 percent basalt pebbles and cobbles. Bedrock is at a depth of more than 60 inches.

Modkin series

The Modkin series consists of moderately deep, well drained soils on basalt plains. These soils formed in sandy windlaid material derived from mixed sources. Slope ranges from 0 to 12 percent. The mean annual precipitation is about 10 inches, and the mean annual air temperature is about 42 degrees F.

Modkin soils are near the Bondbranch, Grassy Butte, and Mathon soils. Bondbranch soils are 10 to 20 inches deep to bedrock. Grassy Butte soils are more than 60 inches deep to bedrock and have a sandy control section. Mathon soils are more than 60 inches deep to bedrock.

Typical pedon of Modkin sandy loam, from an area of Mathon-Rock outcrop-Modkin complex, 0 to 12 percent slopes; about 2 miles west of Quayle Lake, about 2,000 feet west of the northeast corner of sec. 23, T. 7 N., R. 38 E.

A11-0 to 5 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular; soft, very friable; common fine and many very fine roots; many very fine interstitial pores; neutral; clear smooth boundary.

A12-5 to 12 inches; brown (10YR 5/3) sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, friable; many fine and very fine roots; many very fine interstitial and few fine tubular pores; neutral; clear smooth boundary.

B2-12 to 17 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; soft, friable; common fine and very fine roots; many very fine interstitial pores; common very fine and medium tubular pores; 5 percent angular basalt pebbles; neutral; abrupt smooth boundary.

Cca-17 to 22 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak fine subangular

blocky structure; soft, friable; common very fine roots; common fine tubular and many very fine interstitial pores; strong effervescence; mildly alkaline; abrupt wavy boundary.

IIR-22 inches; basalt.

Depth to bedrock is 20 to 40 inches. The A horizon has value of 5 or 6 dry. The dark color in this horizon is partially caused by dark, basaltic sand grains. The B horizon has value of 5 or 6 dry and 3 or 4 moist and chroma of 2 or 3. In some areas the C horizon contains few to common cicada nodules.

Panmod series

The Panmod series consists of moderately deep over hardpan, well drained soils on mountain foot slopes. These soils formed in silty windlaid material on basalt plains. Slope ranges from 4 to 12 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 40 degrees F.

Panmod soils are near Pocatello variant, Rexburg, Ririe, and Swanner soils. Pocatello variant, Rexburg, and Ririe soils are more than 40 inches thick. Swanner soils are 10 to 20 inches thick. None of these soils have a duripan.

Typical pedon or Panmod silt loam, from an area of Panmod silt loam, 4 to 12 percent slopes; 480 feet east, 60 feet north of the center of sec. 7, T. 5 N., R. 41 E.

Ap-0 to 6 inches; brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium and few very fine roots; many very fine and few fine interstitial pores; slight effervescence; moderately alkaline; abrupt smooth boundary.

A12-6 to 11 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; moderate very fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine and few fine interstitial pores; slight effervescence; moderately alkaline; abrupt smooth boundary.

B21-11 to 17 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine and few fine tubular pores; violent effervescence; moderately alkaline; clear wavy boundary.

B22-17 to 23 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak coarse subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine and few fine tubular pores; violent effervescence; strongly alkaline; clear wavy boundary.

B3-23 to 25 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak fine prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine tubular pores; violent effervescence; strongly alkaline; abrupt wavy boundary.

C1casim-25 to 36 inches; pinkish white (7.5YR 8/2) duripan, pink (7.5YR 8/4) moist; strong, very thick platy structure; extremely hard, extremely firm; many very fine roots; matted on surface of plates and in cracks between plates; violent effervescence; strongly alkaline; abrupt wavy boundary.

C2-36 to 50 inches; pinkish white (7.5YR 8/2) silt loam with 5 to 15 percent 2- to 5-centimeter hardpan chips, pinkish gray (7.5YR 7/2) moist; strong very fine granular structure; very hard, very firm, slightly sticky, slightly plastic; common very fine roots; violent effervescence; strongly alkaline; abrupt wavy boundary.

C3casim-50 to 60 inches; pinkish white (7.5YR 8/2) duripan, pink (7.5YR 8/4) moist; strong thick platy structure; extremely hard, extremely firm; material from above layer between plates; violent effervescence; strongly alkaline; abrupt wavy boundary.

In some places the duripan directly overlies bedrock. Depth to the hardpan ranges from 20 to 40 inches (fig. 16). Five to 10 percent hardpan chips are in some profiles. The A horizon has value of 5 or 6 dry. The B horizon, if present, has value of 6 or 7 dry and chroma of 2 or 3.

Pocatello Variant

The Pocatello Variant consists of deep, well drained soils on dissected plateaus. These soils formed in silty windlaid material. Slope ranges from 2 to 60 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 40 degrees F. These soils receive slightly more moisture than is typical for the Pocatello series.

These Pocatello Variant soils are near Panmod, Rammel, Rexburg, Ririe, and Swanner soils. Panmod soils have a hardpan at a depth of 20 to 40 inches. Swanner soils are 10 to 20 inches deep to bedrock. Rexburg soils have a cambic horizon and have the upper boundary of the calcic horizon below a depth of 18 inches. Ririe soils have a mollic epipedon. Rammel soils are 20 to 40 inches deep to bedrock.

Typical pedon of Pocatello Variant silt loam, from an area of Pocatello Variant silt loam, 4 to 8 percent slopes; 1 mile southeast of Rexburg; 1,250 feet south and 660 feet east of the northwest corner of sec. 32, T. 6 N., R. 40 E.

Ap-0 to 7 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; very

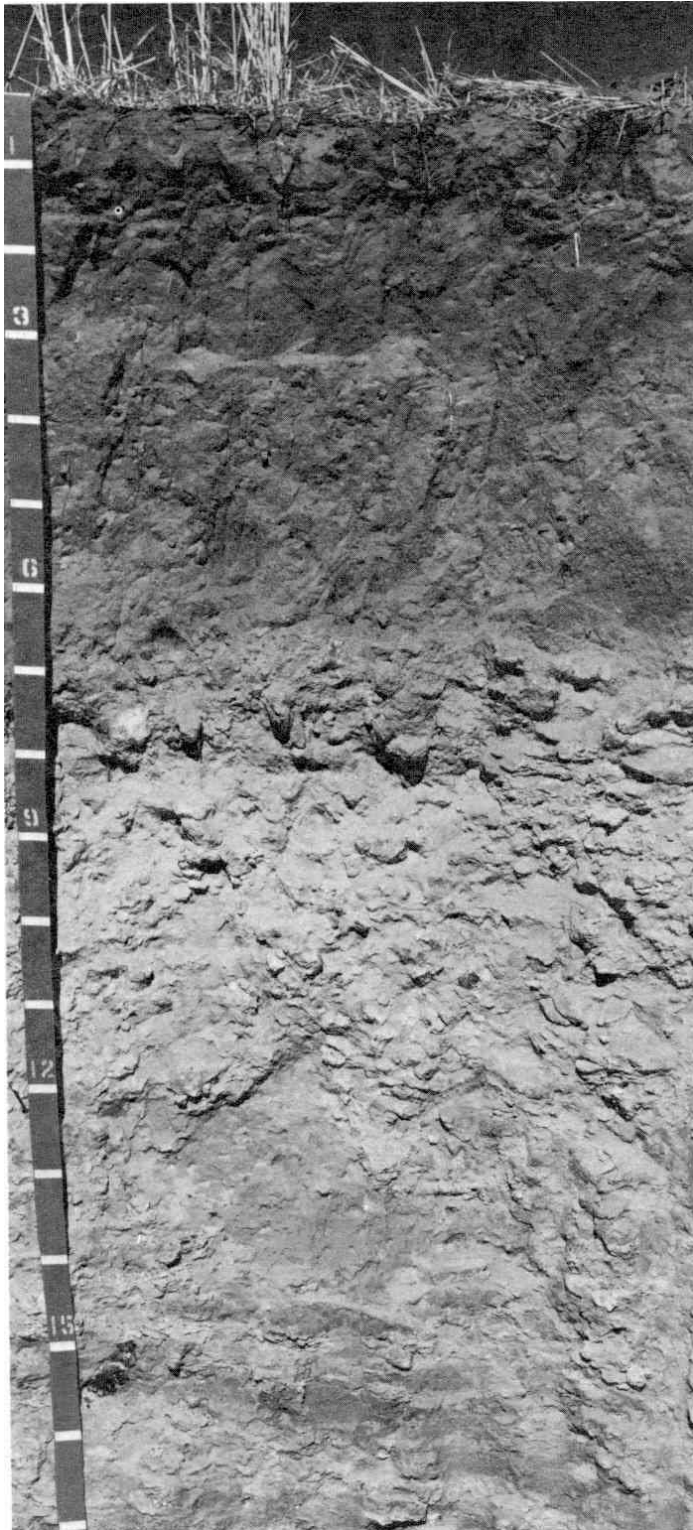


Figure 16.-Profile on Panmod silt loam, showing the hardpan at a depth of 70 to 100 centimeter increments.

weak, very fine granular structure; slightly hard, friable, slightly plastic; few very fine and fine roots; many very fine and coarse vesicular pores in upper 2 inches, common very fine and fine tubular pores from 2 to 7 inches; strong effervescence; mildly alkaline; clear wavy boundary.

C1-7 to 12 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, coarse subangular blocky structure; slightly hard, friable; common very fine and fine tubular pores; strong effervescence; moderately alkaline; clear wavy boundary.

C2ca-12 to 26 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; slightly hard, friable; few very fine and fine roots; many very fine and fine tubular pores; occasional rounded soil nodules; violent effervescence; moderately alkaline; clear wavy boundary.

C3ca-26 to 40 inches; light gray (10YR 7/1) silt loam, grayish brown (10YR 5/2) moist; very weak, coarse subangular blocky structure; slightly hard, friable; few very fine and fine roots; many very fine and fine tubular pores; violent effervescence; moderately alkaline; abrupt wavy boundary.

C4ca-40 to 60 inches; same as C3ca except massive structure.

The 10- to 40-inch control section is silt or silt loam with a high content of coarse silt and 12 to 18 percent clay. The Ap horizon has value of 5.5 to 6.5 dry and 3.5 to 4.5 moist and chroma of 2. In most pedons the A horizon has slight or strong effervescence, but in some undisturbed pedons the upper few inches are noncalcareous.

The C horizon above a depth of 10 to 15 inches has color similar to the A horizon. The soil has violent effervescence below a depth of 8 to 20 inches and has 15 to 22 percent calcium carbonate. Lime content decreases by less than 5 percent above a depth of 40 inches.

Rammel series

The Rammel series consists of moderately deep, well drained soils on rhyolitic canyon sides. These soils formed in silty windlaid material. Slope ranges from 8 to 60 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 39 degrees F.

Rammel soils are near Greys, Lantonia, Pocatello variant, Karlan, and Swanner soils. Greys soils are more than 60 inches deep. Depth to the calcic horizon ranges from 35 to 60 inches in the Lantonia soils. Pocatello variant soils do not have an argillic horizon and are more than 60 inches deep. Swanner soils do not have an argillic horizon and are less than 20 inches deep. Karlan soils do not have an argillic horizon.

Typical pedon of Rammel very stony loam, from an area of Rammel-Rock outcrop complex, 20 to 60 percent slopes; 9 miles southeast of Newdale; 20 feet south and 1,155 feet east of the northwest corner of sec. 7, T. 5 N., R. 43 E.

A1-0 to 8 inches; dark grayish brown (10YR 4/2) very stony loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many very fine and fine, few coarse roots; neutral; gradual wavy boundary.

B21t-8 to 18 inches; brown (10YR 5/3) stony loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; hard, friable, sticky, slightly plastic; common very fine and fine and few coarse roots; many very fine and fine tubular pores; mildly alkaline; gradual wavy boundary.

B22t-18 to 26 inches; brown (10YR 5/3) stony loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky, slightly plastic; common very fine and fine and few coarse roots; many very fine and fine tubular pores; thin nearly continuous clay films on vertical surfaces; mildly alkaline; gradual wavy boundary.

Cca-26 to 31 inches; pale brown (10YR 6/3) stony loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; common very fine and fine tubular pores; 1-inch layer immediately overlying bedrock is very pale brown (10YR 7/3) and has violent effervescence, pale brown (10YR 6/3) moist; slight effervescence; moderately alkaline; clear wavy boundary.

R-31 inches; weathered rhyolitic tuff.

Depth to bedrock ranges from 20 to 40 inches. The A horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The B horizon has value of 5 or 6 dry and 3 or 4 moist and chroma of 3 or 4. The C horizon contains 3 to 15 percent carbonates and more than 50 percent rock fragments in some pedons.

Rexburg series

The Rexburg series consists of deep, well drained soils on dissected plateaus. These soils formed in silty windlaid material. Slope ranges from 0 to 20 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 40 degrees F.

Rexburg soils are near Panmod, Pocatello variant, Ririe, and Swanner soils. Panmod soils have a hardpan at a depth of 20 to 40 inches. Pocatello variant soils do not have a mollic epipedon. Ririe soils do not have a cambic horizon, and the upper boundary of the calcic horizon is above a depth of 16 inches. Swanner soils are 10 to 20 inches deep.

Typical pedon of Rexburg silt loam, from an area of Rexburg silt loam, 0 to 2 percent slopes; 2 miles south

east of Rexburg, 1,200 feet south and 280 feet west of the northeast corner of sec. 4, T. 5 N., R. 40 E.

Ap-0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; very weak fine granular structure; hard, friable, slightly sticky, slightly plastic; mildly alkaline; clear wavy boundary.

A3-7 to 12 inches; dark grayish brown (10YR 4/2) silt loam, dark brown (10YR 3/3) moist; very weak coarse prismatic structure; hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine tubular pores; mildly alkaline; clear wavy boundary.

B2-12 to 19 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure; hard, firm, slightly sticky, slightly plastic; few very fine and fine roots; many very fine tubular pores; moderately alkaline; clear wavy boundary.

B3ca-19 to 21 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine tubular pores; slight effervescence; moderately alkaline; clear wavy boundary.

C1ca-21 to 35 inches; light gray (10YR 7/1) silt loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to coarse angular blocky; hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine tubular pores; violent effervescence; moderately alkaline; clear wavy boundary.

C2ca-35 to 60 inches; light gray (10YR 7/1) silt loam, light gray (10YR 7/2) moist; weak fine granular structure; hard, friable, slightly plastic; few very fine and fine roots; .15 percent of this horizon consists of duripan chips; violent effervescence; moderately alkaline.

The control section is silt loam with 8 to 18 percent clay. Depth to the calcic horizon ranges from 18 to 35 inches. The mollic epipedon is 12 to 20 inches thick. The A horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The B horizon has value of 5 or 6 dry and 3 to 5 moist and chroma of 2 or 3. The calcic horizon has 15 to 30 percent calcium carbonate equivalent.

Ririe series

The Ririe series consists of deep, well drained soils on dissected plateaus. These soils formed in silty windlaid material. Slope ranges from 0 to 30 percent. The mean annual precipitation is about 15 inches, and the mean annual air temperature is about 39 degrees F.

Ririe soils are near Ard, Greys, Karlan, Panmod, Rexburg, Pocatello Variant, and Tetonia soils. Ard soils are moderately deep to bedrock. Greys soils do not have a calcic horizon. Karlan soils have 18 to 27 percent clay in the control section. Panmod soils have a cemented

hardpan at a depth of 20 to 40 inches. Pocatello variant soils do not have a mollic epipedon. Rexburg soils have a cambic horizon, and the upper boundary of the calcic horizon is below a depth of 18 inches. Tetonia soils have a mollic epipedon thicker than 16 inches, are 16 to 35 inches deep to the calcic horizon, and have a cryic temperature regime.

Typical pedon of Ririe silt loam, from an area of Ririe silt loam, 4 to 8 percent slopes; about 9 miles east of Newdale; 200 feet west and 900 feet north of the southeast corner of sec. 7, T. 6 N., R. 43 E.

Ap-0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; moderately alkaline; abrupt smooth boundary.

A12-5 to 9 inches; grayish brown (10YR 5/2) silt loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak fine and very fine granular; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine roots; many very fine tubular pores; moderately alkaline; abrupt smooth boundary.

C1ca-9 to 14 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; very weak coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, friable, sticky, slightly plastic; common very fine and fine roots; many very fine tubular pores; violent effervescence; moderately alkaline; clear wavy boundary.

C2ca-14 to 30 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; weak medium and fine angular blocky structure; hard, firm, slightly sticky, slightly plastic; very fine tubular pores; slightly finer textured than preceding horizon; 40 percent of this horizon consists of lime veins and splotches (10YR 8/2) dry and (10YR 6/3) moist; common 1/2-inch nodules of soil material; violent effervescence; moderately alkaline; clear wavy boundary.

C3ca-30 to 44 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; very weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; many very fine tubular pores; occasional cicada holes and few lime veins; violent effervescence; moderately alkaline.

C4ca-44 to 60 inches; same as C3ca except slightly lighter texture and massive structure.

The mollic epipedon ranges from 7 to 16 inches in thickness. At a depth of 10 to 40 inches, these soils are silt loam, containing 12 to 18 percent clay and less than 15 percent particles coarser than very fine sand. They are generally noneffervescent to a depth of 8 inches, except where eroded. The A horizon has value of 4 or 5 dry and 2 or 3 moist. The Cca horizon has value of 6 or 7 dry and 3 to 5 moist.

Swanner series

The Swanner series consists of well drained soils on canyon side toe slopes and escarpments between plateaus and bottom lands. These soils formed in silty windlaid material with a mixture of residuum from rhyolite and are shallow. Slope ranges from 2 to 60 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 40 degrees F.

Swanner soils are near Ard, Panmod, Pocatello variant, Rammel, and Rexburg soils. Ard and Rammel soils are 20 to 40 inches deep. Panmod soils have a hardpan at a depth of 20 to 40 inches. Pocatello variant soils do not have a mollic epipedon and are deeper than 60 inches. Rexburg soils have a cambic horizon, and the upper boundary of the calcic horizon is below a depth of 18 inches.

Typical pedon of Swanner extremely stony loam, from an area of Swanner-Rock outcrop complex, 2 to 30 percent slopes; 2 1/2 miles east of Lyman; 1,520 feet north and 275 feet west of the southeast corner of sec. 28, T. 5 N., R. 40 E.

A1-0 to 6 inches; grayish brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) moist; very weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; many very fine and fine roots; mildly alkaline; clear wavy boundary.

C1-6 to 10 inches; brown (10YR 5/3) very stony loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; moderately alkaline; clear wavy boundary.

C2ca-10 to 16 inches; light yellowish brown (10YR 6/4) extremely stony loam, brown (10YR 4/3) moist; weak coarse prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; violent effervescence; moderately alkaline; abrupt wavy boundary.

IIR-16 inches; pinkish gray (5YR 6/2) rhyolite or rhyolitic tuff bedrock; lime coatings on rhyolitic tuff and bedrock.

A lithic contact with rhyolite, rhyolitic tuff, latite, or closely related bedrock is at a depth of 10 to 20 inches. The control section is medium textured and contains 35 to 80 percent, by volume, angular gravel and other platy or angular rock fragments. The mollic epipedon ranges from 6 to 10 inches thick.

The A1 horizon has value of 4 or 5 dry and 2 or 3 moist. It is generally noneffervescent. The Cca horizon contains 3 to 15 percent calcium carbonate equivalent.

Tetonia series

The Tetonia series consists of deep, well drained soils on dissected plateaus. These soils formed in silty wind-

laid material. Slope ranges from 0 to 20 percent. The mean annual precipitation is about 15 inches, and the mean annual air temperature is about 39 degrees F.

Tetonia soils are near Ard, Greys, Karlan, Lantonia, and Ririe soils. Ard soils are 20 to 40 inches deep to bedrock, and Ard and Ririe soils have a mollic epipedon less than 16 inches thick. In the Ririe soils, the upper boundary of the calcic horizon is above a depth of 16 inches. Greys soils do not have a calcic horizon. Lantonia soils have sola thicker than 35 inches, and depth to the calcic horizon ranges from 35 to 60 inches. Karlan soils have 18 to 27 percent clay in the control section.

Typical pedon of Tetonia silt loam, from an area of Tetonia-Ririe silt loams, 4 to 12 percent slopes; about 7 1/2 miles northeast of Newdale; about 75 feet north and 2,640 feet east of the southwest corner of sec. 30, T. 7 N., 43 E.

A1-0 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and thick platy structure; slightly hard, friable, slightly plastic; common fine roots; few very fine tubular pores; mildly alkaline; abrupt smooth boundary.

B2-10 to 22 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, slightly plastic; common fine roots; many very fine tubular pores; mildly alkaline; abrupt wavy boundary.

C1ca-22 to 30 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, firm, slightly plastic; few fine roots; many very fine tubular pores; few roots below a depth of 31 inches; strong effervescence; moderately alkaline; gradual wavy boundary.

C2ca-30 to 47 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, firm, slightly plastic; few fine roots; many very fine tubular pores; many 1/2-inch cicada nodules and lime veins; violent effervescence; moderately alkaline; gradual wavy boundary.

C3ca-47 to 60 inches; same as C2ca except massive; slightly hard, friable, common very fine tubular pores; few 1/2-inch cicada nodules and few refilled rodent holes; strongly alkaline.

The control section is silt loam, containing 10 to 18 percent clay and less than 15 percent particles coarser than very fine sand. Depth to the calcic horizon is 17 to 35 inches (fig. 17). The mollic epipedon is 17 to 25 inches thick. The A horizon has value of 4 or 5 dry and 2 or 3 moist.

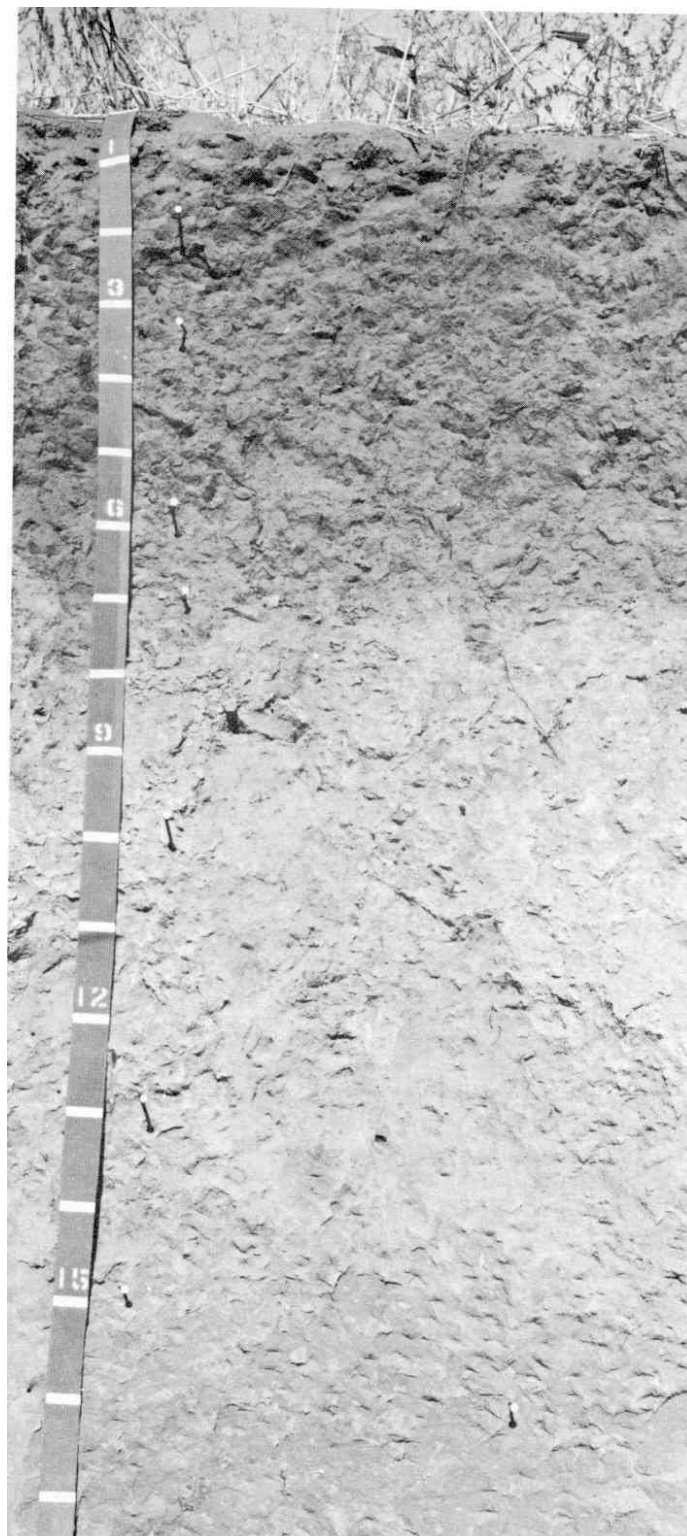


Figure 17.-Profile of Tetonia silt loam, showing the accumulation of lime beginning at a depth of 68 centimeters (27 inches). Marks on tape are in 10-centimeter increments.

Turnerville series

The Turnerville series consists of deep, well drained soils on dissected plateaus. These soils formed in silty windlaid material with some influence by rhyolitic material. Slope ranges from 2 to 20 percent. The mean annual precipitation is about 20 inches, and the mean annual air temperature is about 39 degrees F.

Turnerville soils are near Greys and Judkins soils. Greys soils have a mollic epipedon. Judkins soils are 20 to 40 inches deep over bedrock.

Typical pedon of Turnerville silt loam, from an area of Turnerville silt loam, 2 to 20 percent slopes; about 16 miles southeast of Rexburg; 1,920 feet west and 2,080 feet south of the northeast corner of sec. 33, T. 5 N., 42 E.

O-3 inches to 0; undecomposed and partially decomposed leaves and twigs.

A11-0 to 2 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine, medium, and coarse roots; many very fine and fine interstitial pores; slightly acid; clear smooth boundary.

A12-2 to 6 inches; light gray (10YR 7/2) silt loam, dark brown (10YR 3/3) moist; moderate fine and very fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; common very fine and fine, medium and coarse roots, many very fine and fine interstitial pores; slightly acid; clear wavy boundary.

A2-6 to 16 inches; light gray (10YR 7/2) silt loam, brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine and fine, common medium and coarse roots; few very fine, fine, and medium tubular pores; slightly acid; clear wavy boundary.

B&A-16 to 25 inches; light gray (10YR 7/2) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm, very sticky, very plastic; few very fine, fine, and medium roots; common very fine and fine and few medium and coarse tubular pores; 30 percent is material from the A2 horizon that has the same colors; slightly acid; clear smooth boundary.

B2t-25 to 57 inches; pinkish gray (7.5YR 7/2) silty clay loam, brown (7.5 5/4) moist; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; very hard, very firm, very sticky, very plastic; few very fine, fine and medium roots; common very fine and fine tubular pores; many thick continuous dark brown (7.5YR 4/2) moist clay films on all surfaces; slightly acid; clear smooth boundary.

B3-57 to 60 inches; light brownish gray (10YR 6/2) silt loam, dark yellowish brown (10YR 4/4) moist; mas-

sive; hard, firm, sticky, plastic; common very fine and fine tubular pores; neutral.

The solum is more than 60 inches thick. Clay films in the B horizon range from thin to thick and nearly continuous to continuous. Texture of the B horizon is heavy silt loam in some pedons.

Wardboro series

The Wardboro series consists of deep, somewhat excessively drained soils on river terraces. These soils formed in mixed alluvium and are shallow to sand and gravel. Slope ranges from 0 to 1 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 41 degrees F.

Wardboro soils are near Bannock, Bockston, Harston, Heiseton, and Labenzo soils. Bannock, Harston, and Labenzo soils are 20 to 40 inches deep to loose sand and gravel. In addition, Bannock and Labenzo soils have a mollic epipedon. Bockston and Heiseton soils are more than 40 inches deep to loose sand and gravel. Also, Bockston soils contain more than 18 percent clay in the control section.

Typical pedon of Wardboro gravelly sandy loam, about 1/4 mile east and 1 mile south of Thornton; 1,300 feet west and 620 feet north of the center of sec. 26, T. 5 N., R. 39 E.

A1-0 to 2 inches; light brownish gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; many very fine and fine roots; many very fine interstitial pores; slight effervescence; mildly alkaline; abrupt wavy boundary.

C1-2 to 12 inches; light brownish gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, very friable; few medium, common fine roots; few very fine tubular pores; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC2-12 to 60 inches; light brownish gray (10YR 6/2) sand and gravel, dark grayish brown (10YR 4/2) moist; single grain; loose; few coarse, many medium roots; about 60 or 70 percent rounded gravel; slight effervescence; mildly alkaline.

The 10- to 40-inch control section is dominantly sand or loamy sand and contains 40 to 75 percent rock fragments. The upper 10 inches is dominantly gravelly sandy loam but is gravelly loam or gravelly loamy sand in some pedons.

Withers series

The Withers series consists of deep, somewhat poorly drained soils on river terraces and flood plains. These soils formed in mixed alluvium and are moderately deep

to sand and gravel. Slope ranges from 0 to 1 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 41 degrees F.

Withers soils are near Annis, Blackfoot, and Labenzo soils. Annis and Blackfoot soils are more than 40 inches deep to sand and gravel. Blackfoot and Labenzo soils have a control section that contains more than 15 percent particles coarser than very fine sand and less than 27 percent clay.

Typical pedon of Withers silty clay loam, about 1/4 mile west of Sugar City; 60 feet south and 100 feet west of the northeast corner of sec. 8. T. 7 N., R. 40 E.

A1-0 to 7 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular structure; slightly hard, friable, slightly sticky, plastic; many very fine and fine roots; many very fine interstitial pores; slight effervescence; moderately alkaline; gradual smooth boundary.

B21-7 to 16 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky, plastic; many medium and fine roots; few medium tubular pores; slight effervescence; moderately alkaline; gradual wavy boundary.

B22-16 to 26 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; common fine faint yellowish brown (10YR 5/4) moist mottles; strong fine and very fine subangular blocky structure; hard, friable, sticky, plastic; common very fine roots; many very fine and common fine tubular pores; common thin and very thin clay films on ped faces; slight effervescence; mildly alkaline; abrupt wavy boundary.

IIC1-26 to 36 inches; pale brown (10YR 6/3) very gravelly loamy sand; brown (10YR 4/3) moist; single grain; loose; many very fine and fine interstitial pores; slight effervescence; mildly alkaline; clear wavy boundary.

IIIC2-36 to 60 inches; sand and gravel with 15 percent cobbles.

These soils have a water table that fluctuates between depths of 2 to 4 feet in summer and early in fall. Depth to the IIC horizon is 20 to 36 inches. The upper part of the textural control section averages 27 to 35 percent clay and 15 percent or more fine sand or coarser. The A horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 1 or 2. The B horizon has value of 5 or 6 dry and 3 to 5 moist and chroma of 2 or 3.

References

1. American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

2. American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D2487-69. In 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

3. Clements, Louis J. and Harold S. Forbush. 1972. Pioneering the Snake River Fork country. Eastern Idaho Pub. Co., 302 pp., illus.

4. United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

5. United States Department of Agriculture. 1960. Engineering handbook. Suppl. a, sec. 4, Hydrol., pp. 3.71 to 3.7-3.

6. United States Department of Agriculture. 1971. Idaho soil and water conservation needs inventory, 1967. Soil Conserv. Serv., 187 pp.

7. United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

8. United States Department of Health, Education, and Welfare. 1957. Manual of septic tank practices. Public Health Serv. Publ. 526, 93 pp., illus.

Glossary

- Alluvium.** Material, such as, sand, silt, or clay, deposited on land by streams.
- Area reclaim** (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.
- Available water capability (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in 60-inch profile or to a limiting layer is expressed as-

	Inches
Very low	less than 3.75
Low	3.75 to 5
Moderate	5 to 7.5
High	more than 7.5

- Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
- Calcareous soil.** A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay,

less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels.
Synonyms: clay coating, clay skin.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are-

Loose.-Noncoherent when dry or moist; does not hold together in a mass.

Friable.-When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.-When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.-When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.-When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.-When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.-When dry, breaks into powder or individual grains under very slight pressure.

Cemented.-Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cool soil. Soil that has an average summer temperature less than 59 degrees F. at a depth of 20 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock. Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.-Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.-Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.-Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.-Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.-Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.-Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in

layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.-Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains.

Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.-An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.-The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.-The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.-The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.-Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are

assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soil to assist in production of crops. Methods of irrigation are-
Border.-Water is applied at the upper end of a strip in ridges called border dikes, or borders.

Controlled flooding.-Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.-Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops so that it flows in only one direction.

Furrow.-Water is applied in small ditches made by cultivation implements. Furrows are used for row crops.

Sprinkler.-Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.-Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is. mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance-*few*, *common*, and *many*, size-*fine*, *medium*, and *coarse*; and contrast-*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables-hue, value, and chroma. For example, a notation of 10YR 6/4 is a. color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms::

Pedon. The smallest volume that "can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percolates slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per. hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow.....	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid.....	2.0 to 6.0 inches
Rapid.....	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, differences in slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.).

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Poorly graded. Refers to a coarse grained soil or, soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities. .

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as-

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that 'greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface, of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are

active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue "left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt*, *silt loam*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The *sand*, *loamy sand*, and *sandy loam* classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the low lands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Warm soil. Soil that has an average summer temperature more than 59 degrees F. at a depth of 20 inches.